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Serum C-reactive Protein and White Blood Cell Level as Markers of Successful Percutaneous Drainage of Acute Sterile Peripancreatic Fluid Collection

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Rezumat

Numărul leucocitelor și nivelul seric al proteinei C reactive - markeri de reușită a drenajului percutan al colecțiilor peripancreatice acute sterile

Informații generale: Drenajul percutan nu reprezintă o metodă utilizată la scală largă la momentul de față în evacuarea colecțiilor sterile de lichid peripancreatic. Cu toate acestea, multe studii clinice au dovedit efectele sale pozitive.
Scop: Am testat modificările la nivelul următorilor parametrici serici: proteina C reactivă (CRP), factorii de complement 3-4 (C 3-4), factorul de necroză tumorală α (TNF-α), amilaza, lipaza și leucograma la pacienții tratați prin drenaj percutan. Pacienți și metode: 10 pacienți cu pancreatită acută severă însoțită de colecție de lichid peripancreatic au fost monitorizați. Parametrii de laborator și cantitatea de lichid drenat au fost cuantificați în prima, a cincea și a 10-a zi. Analiza statistică a fost efectuată cu ajutorul programului Statistica for Windows (Version 7.0). Valori ale p mai mici de 0,05 au fost considerate semnificative din punct de vedere statistic.
Rezultate: Am identificat o corelație pozitivă semnificativă între CRP, numărul de leucocite și volumele de lichid drenat. Am utilizat acești markeri drept parametri ai drenajului percutanat efectuat cu succes la pacienții cu pancreatită acută severă complicată cu lichid peripancreatic steril. Nu s-au identificat modificări semnificative ale nivelurilor de C3-4, TNF-α, amilază și lipază.
Concluzii: Monitorizarea nivelului de CRP și a numărului de leucocite este de recomandat în urmărirea pacienților după drenajul percutan de lichid peripancreatic.

Cuvinte cheie: colecție lichidiană peripancreatică acută, proteină de fază acută, drenaj percutan

Abstract

Background: Percutaneous drainage is not a widely used therapeutic method recently for evacuating peripancreatic sterile fluid collections in patients with severe acute pancreatitis. However, many clinical studies have proved its positive effects.
Aim: We tested the changes in serum laboratory parameters: C-reactive protein (CRP), complement factor 3-4 (C 3-4), tumor necrosis factor-α (TNF-α), amylase, lipase and white blood cell (WBC) count in patients treated by percutaneous drainage.
Patients and Methods: 10 patients with severe acute pancreatitis with peripancreatic fluid collection were monitored. Laboratory parameters and the amount of drained fluid were measured on the 1st, 5th and 10th day. Statistical analysis was performed by using Statistica for Windows (Version 7.0) software. P values less than 0.05 were considered statistically significant.
Results: We found significant positive correlation between the CRP and WBC serum level and volumes of the drained fluid. We used these parameters as markers of successful percutaneous drainage in case of patients with severe acute pancreatitis complicated with sterile peripancreatic fluid. There was no significant change in the levels of C 3-4, tumor necrosis factor-α, amylase and lipase.
Conclusions: Monitoring of serum CRP and WBC levels may be recommended for follow up after percutaneous drainage of peripancreatic fluid.

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Abbreviations: CRP: C-reactive Protein TNFα: Tumour Necrosis Factor-α, C3-4: Complement 3-4 WBC: White Blood Cell CT: Computed Tomography

Key words: acute peripancreatic fluid collection, acute phase protein, percutaneous drainage

Introduction

Treatment of concomitant sterile acute fluid collections in severe acute pancreatitis with percutaneous drainage is not a widely used therapy method nowadays. According to some papers fluid collections can resolve spontaneously. Some authors found that iatrogenic infections may result as serious complications of the procedure. (5) On the other hand there are several studies reporting good results of drainage therapy. (4,10,12,16,17)

In our present prospective study the effects of percutaneous drainage of sterile acute fluid collections on the changes of serum C-reactive protein (CRP), Complement 3-4 (C 3-4), tumor necrosis factor-α (TNF-α), Amylase, Lipase levels and peripheral white blood cell (WBC) count were analysed.

Patients and Methods

This prospective study included 10 patients treated by percutaneous drainage for large amount of sterile acute peripancreatic fluid collections. As part of the conservative therapy, beside the percutaneous drainage, naso-jejunal feeding was applied in all cases. Initially antibiotic medication (Imipen-Cilastatin) was given only to those 6 patients who had fever and elevated inflammatory laboratory parameters. Surgery was indicated in case of septic necrosis but only when conservative treatment (antibiotics) and/or percutaneous drainage was unsuccessful. Our patients' (8 males, 2 females) average age was 53.5 years. Severe acute pancreatitis was caused by gallstone in 3 cases and alcoholic abuse in 7 cases.

Size and localization of the fluid collection were visualised by contrast enhanced CT in all cases.

Fluid collection caused compressive symptoms (abdominal distension, pain) in all the 10 patients. CT guided percutaneous drainage was performed in all patients, after 4.3 days (3-7 days) from the onset. In one case it was necessary to perform double drainage at the same time, because of separated localization of the fluid collection. Only those 10 patients who were not operated on before the 10th day following the insertion of the pigtail catheter were included in this study.

To monitor the detoxification process of the patient besides the cessation of the compressive symptoms due to the drainage, the levels of some acute phase proteins and WBC count were also examined. Right before the intervention (1st day), then on the 5th and 10th day the levels of serum CRP, C3-4 and TNF-α, Amylase, Lipase and WBC count were measured. The quantity and quality of the drained fluid collection on the 1st, 5th and 10th days was also registered.

Informed consent was obtained from each patient, and the project as a whole was approved by the hospital ethical committee

The changes in the laboratory parameters were analysed statistically. Statistical differences were determined by paired Student's T-test if data exerted normal distribution, otherwise the Wilcoxon probe was performed; p values less than 0.05 were considered statistically significant.

Results

Six patients suffered extensive pancreas necrosis. Surgery (necrectomy, drainage of the omental bursa) had to be performed in case of these patients because of superinfection of the necrotised pancreas tissue. The other 4 patients fully recovered due to the applied drainage and conservative therapy. One of the patients died of extended, nearly total necrosis of the pancreas.

On the 1st day of drainage the level of the serum CRP was 165.8 (7.2-244.6) mg/L, on the 5th day it was 112.94 (23.8-286) mg/L, on the 10th day it was 77.66 (15.6-173) mg/L. We registered significant decrease of serum CRP level between the 1st and 5th days. There was no significant decrease in serum CRP level between the 5th and 10th days, however the difference between the initial and final levels (day 10) were found to be statistically significant.

Serum WBC count was 10.3 (6-15.9) G/L on the 1st day, 9.1 (5.3-15) G/L on the 5th day and 8.5 (4.7-14.9) G/L on the 10th day. Decrease of serum WBC count was considerable without significance, and we registered significant decrement between the WBC levels measured on the 1st and 10th days.

Complement-3 levels were 1.24 (0.82-1.72) g/L on the 1st day, 1.25 (0.51-1.73) g/L on the 5th day and 1.41 (1.11-1.92) g/L on the 10th day. We found moderate increase of the C-3 serum levels without significance. Complement-4 was an average 0.23 (0.1-0.39) g/L on the 1st day, 0.23 (0.1-0.34) g/L on the 5th day and on the 10th day it was 0.33 (0.19-0.5) g/L. Moderate increase is also detected in case of C-4, however we found significant difference only between the C-4 serum levels measured on the first and 10th day. We detected moderate increase without significance in case of the 6 patients who had an operation, but in case of the 4 patients whose condition did not need operation the serum levels did not change. It seems that the C3-4 levels can be considered as prognostic parameters on being a candidate for surgery in those cases when the levels present increasing tendency.

Serum level of Amylase was 642.6 (78-2326) U/L on the 1st day, 200.1 (29-607) U/L on the 5th day and 201.7 (39-571) U/L on the 10th day. The serum Lipase levels on the 1st day were 309.4 (39-730) U/L, on the 5th day 200.1 (29-607) U/L and on the 10th day were 201.7 (39-571) U/L. Both of the serum Amylase and Lipase levels decreased during drainage without significance. (*Fig. 1*)

Decrease in the amount of drained fluid was statistically significant between the 1st (690 ml) and 5th days (365 ml), the 5th and 10th (190 ml) days and the 1th and 10th days as well.

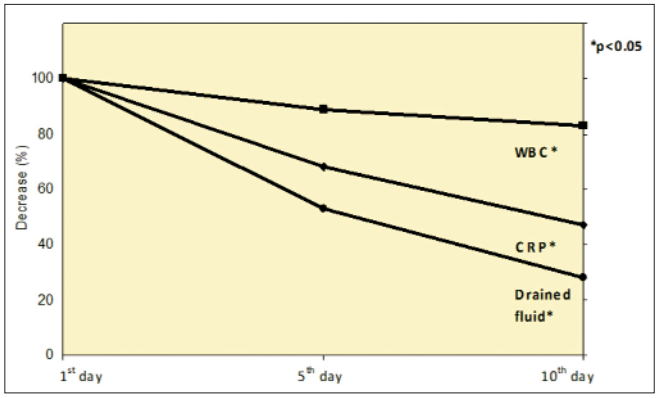

Figure 1. *Decrease of crucial parameters (white blood cell count, serum lipase, serum C reactive protein, serum amylase level, and the amount of drained fluid) during the monitoring term in patients with severe acute pancreatitis*
Abbrevations: CRP: C-reactive Protein, WBC: White Blood Cell

(*Fig. 1*)

Considering the serum levels of TNF-α during drainage therapy we did not find significant change.

From the monitored laboratory parameters the levels of CRP, Amylase, Lipase and the WBC count and the quantity of the drained fluid gradually decreased during the interventional management (*Table 1*). The levels of TNF-α and C3-4 did not decrease during the treatment, moreover the level of C3-4 increased in the cases of operated patients.

Discussion

Percutaneous drainage as a treatment of concomitant acute fluid collections and acute pseudocysts in severe acute pancreatitis raises several questions.

According to some experts these sterile, acute fluid collections resolve spontaneously and do not need any treatment. (12,13,15) On the contrary, in clinical practice we are often constrained to drain these fluid collections because of the compressive symptoms, the increasing abdominal pressure and pain. (4,10,12,16,17)

The other cardinal problem in the management of the initially sterile fluid collection can be its superinfection. Some authors refer that it is the treatment itself which causes the septic complication as an iatrogenic infection. According to the literature the rate of iatrogenic infection can be estimated from 8 to 27% (5,12). Walser et al. reported a study with a very high (50%) superinfectious rate, what can be a result of the irrigations performed 2-3 times a day (5). To evaluate the proper iatrogenic infectious rate further prospective randomized trials are required. For the management of sterile fluid collections percutaneous puncture and drainage are often used recently. The suitability of applying repeated puncture or drainage is a controversial topic. Some authors suggest that it is enough to aspirate the fluid collection with a single puncture (11,15). Despite the fact that the success of this is limited, drainage or operation is needed in most of the cases following a single intervention (5,11,16).

According to the supporters of drainage therapy in the treatment of sterile acute peripancreatic fluid collections drainage can be applied successfully. (4,10,12,16,17).

Most of the laboratory parameters during severe acute pancreatitis have been analysed whether they have diagnostic or prognostic importance. There is a high suspicion of necrotising process in the background when the serum level of acute phase proteins elevate, and changing of the serum level of these parameters denotes significant positive correlation with the progress of acute pancreatitis. One of the most frequently analysed parameters is CRP, correlating with the severity, recovery and superinfection rate in severe acute pancreatitis and acute fluid collections (1,2,14,17). Only few studies performed focus on the changes of the serum level of CRP in cases with concomitant fluid collections and during drainage therapy (3,17). Highest serum CRP levels are registered between the 3-5th days in severe cases and later on it decreases to 160-200 mg/l (1,2,14). In cases when acute sterile or septic fluid collections are not associated with the condition the CRP level does not decrease, but stagnates or increases again (3).

Several studies have proved that the concomitant fluid collection in acute pancreatitis contains toxic substances which can be responsible for the high mortality risk in cases of severe acute pancreatitis. (6,7,8,9) Some authors provoked

Table 1. *Level of crucial parameters (serum C reactive protein, white blood cell count, serum lipase, serum amylase level, and the amount of drained fluid) during the monitoring term in patients with severe acute pancreatitis*

	1st day	5th day	10th day
	p (1-5th day)		p (5-10th day)
		p (1-10th day)	
CRP (mg/L)	165.8 (7.2 -438)	112.9 (23.8-286)	8.5 (4.7-14.9)
p(1-5th), p(5-10th)	P=0.002*		p=0,142
P(1-10th)		p=0.01*	
WBC (G/L)	10.27 (6.0–15.9)	9.11 (5.3–15)	8.5 (4.7–14.9)
p(1-5th), p(5-10th)	p=0.146		p= 0.082
P(1-10th)		p=0.03*	
Drained fluid (ml)	690 (350–1800)	365 (150–800)	190 (50–600)
p(1-5th), p(5-10th)	P=0.041*		P=0.038*
P(1-10th)		P=0.035*	

*p<0.05

early mortality by injection of aspirated acute fluid collection to rats and mice intraperitoneally. (6,9)

At present, study of the levels of CRP, Amylase, Lipase and the WBC count gradually showed that they decreased from the initial state (before drainage) during drainage, indicating the effectiveness of the management.

The changes of TNF-α and C3-4 levels do not correlate with the drainage though the C3-4, CRP levels and the WBC count correlate well with the probability of surgery; that is why they can be considered as prognostic factors.

In summary, the decrease in the measured laboratory parameters (CRP, Amylase, Lipase, WBC) proves our supposition that the drainage of the acute fluid collection does not eliminates the compressive symptoms but it has a positive effect on the detoxification of the patients. In case of sterile acute fluid collections, the monitoring of the WBC count and serum CRP level can predict surgical management. The changes of the CRP level and WBC count can be recommended for the laboratory monitoring of the efficacy of percutaneous drainage of peripancreatic fluid.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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