Albumin Concentration and Properties in the Blood and Exudate in Acute Pancreatitis

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The concentration of albumin and the state of its binding centers in the serum and abdominal exudate from patients with acute pancreatitis were evaluated using a fluorescent technique. The total albumin concentration was below normal by 33%. The ratio of effective to total concentration also decreased attesting to conformational changes in the albumin molecule. Albumin molecules are released into exudate in its native form, but sometimes albumin in the exudate is dramatically changed probably due to bursa omentalis seal failure and its concentration sharply decreased probably due to proteolytic degradation.

Key Words: *pancreatitis; exudate; albumin; fluorescent technique*

Recently developed fluorescent technique allows to evaluate both total albumin content [3,4] and changes in its binding centers [5,6]. Changes in albumin molecule observed in many diseases [1,2] can be described by three parameters: total albumin concentration (TAC), effective concentration (EAC) characterizing molecular conformation, and the EAC/TAC ratio. Under normal conditions EAC and TAC are equal and EAC/TAC=1, while in various pathologies EAC usually decreases; the greater changes in albumin molecule, the more EAC/TAC ratio deviates from 1 [1,2].

We used a fluorescent technique to investigate albumin concentration and properties in exudate in comparison with the corresponding parameters in the blood.

MATERIALS AND METHODS

Measurements were performed with a standard technique using Albumin-Probe reagents (Zond) and an AKL-01 analyzer [1,3,4].

The study included 20 patients aged from 21 to 75 with acute edematic pancreatitis (2), with fatty pancreonecrosis (1), and with hemorrhagic pancreonecrosis (17, of them 7 lethal outcomes). TAC and EAC were measured in parallel serum and exudate samples: a total of 62 serum-abdominal exudate and 8 serum-bursa omentalis exudate paires.

RESULTS

Serum albumin concentration in patients was markedly reduced (Table 1): in almost $^2/_3$ samples TAC was below 30 g/liter, while in donors such low value were extremely rare. This implies a considerable (about 33%) loss of blood albumin. The serum EAC/TAC ratio dropped to 0.7-0.5, which indicates severe changes in albumin molecule properties as a result of progression of the pathological process.

TAC in the abdominal exudates varied from 0 to serum level (Fig. 1, *a*) in 68 out of 70 samples, but some cases of diffuse enzymatic peritonitis were characterized by very low TAC in the exudate. No correlation was found between exudate TAC and inflammation severity. In the majority of patients EAC/TAC ratio reflecting changes in the albumin molecule (Fig. 1, c) was similar in the abdominal exudate and serum and their mean values were practically identical (Table 1). It implies that albumin molecule does not change during passage from the blood into exudate. Significant

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TABLE 1. Variation Ranges and the Mean Values of TAC, EAC, and TAC/EAC Ratio in Serum and Exudate from Patients with Acute Pancreatitis ($M \pm \sigma$)

Parameter	Serum		Exudate			
			Abdomen		Bursa omentalis	
	Range	Mean value	Range	Mean value	Range	Mean value
TAC, g/liter	9-59	29.3±1.2	0-36	16.6±1.3	0-16	9.4±2.2
EAC, g/liter	8-46	20.8±0.9	0-29	11.4±1.1	0-8	2.5±1.1
EAC/TAC	0.48-1.02	0.70±0.02	0-0.95	0.68±0.03	0-0.45	0.24±0.09

changes in exudate albumin occurred only in some patients with severe hemorrhagic pancreonecrosis (very low EAC/TAC values) and half of them died.

In bursa omentalis exudates, TAC and EAC/TAC were considerably lower than in the serum (sometimes about zero). For EAC/TAC this difference reached 44-100%, while for the majority of abdominal exudates (84%) it did not exceed 44% (straight lines in Fig. 1, *c*). Such low values of EAC/TAC have never been observed in the serum [2], which suggests that albumin molecules undergo significant changes in the exudate.

In one patient with total hemorrhagic pancreonecrosis exudate samples were taken during surgery separately from the lower and upper parts of the peritoneal cavity and bursa omentalis (the points marked by circle in Fig. 1, *c*). The EAC/TAC values in the bursa omentalis and upper abdomen were similar and significantly lower than in the blood, while those in the

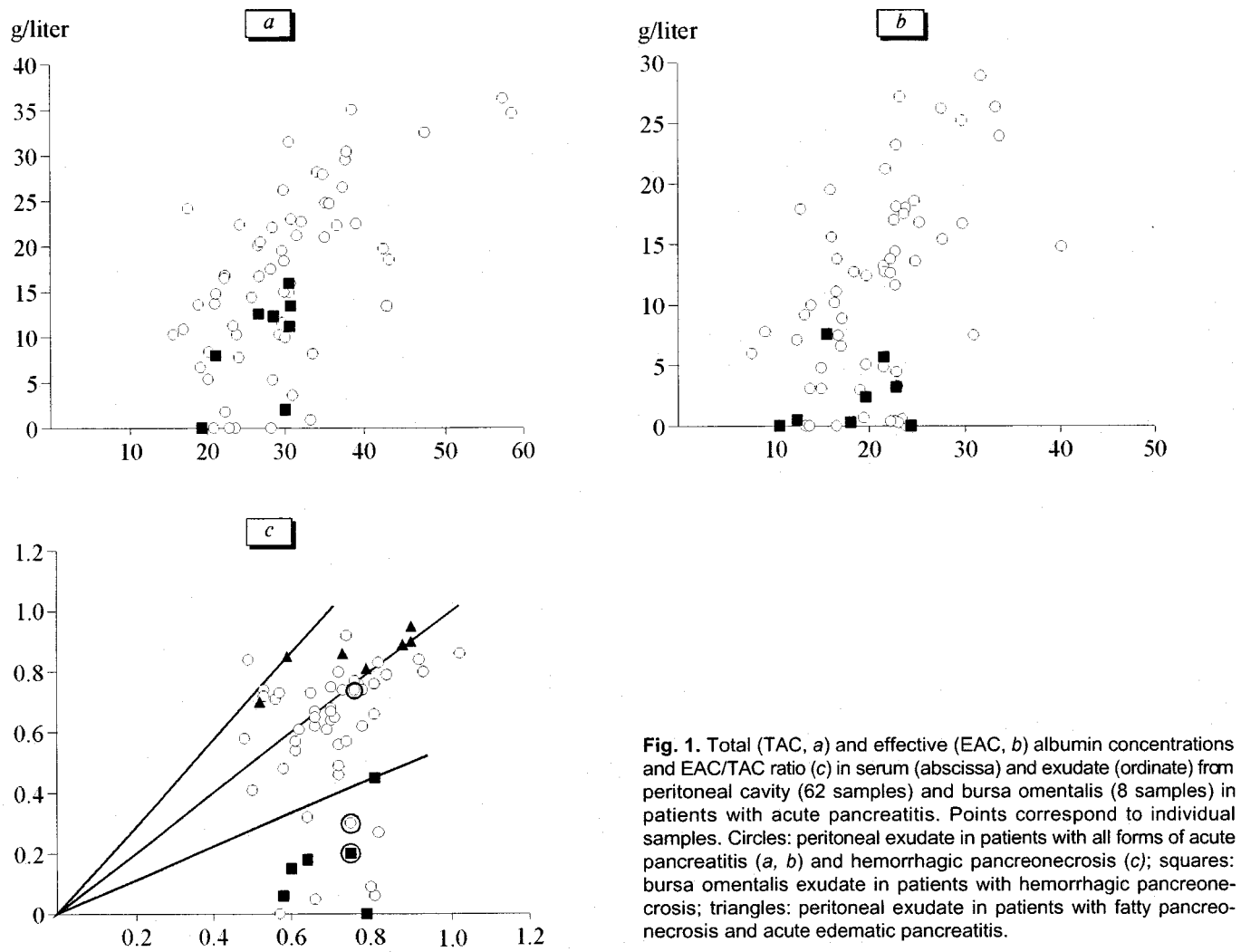

Fig. 1. Total (TAC, *a*) and effective (EAC, *b*) albumin concentrations and EAC/TAC ratio (*c*) in serum (abscissa) and exudate (ordinate) from peritoneal cavity (62 samples) and bursa omentalis (8 samples) in patients with acute pancreatitis. Points correspond to individual samples. Circles: peritoneal exudate in patients with all forms of acute pancreatitis (*a, b*) and hemorrhagic pancreonecrosis (*c*); squares: bursa omentalis exudate in patients with hemorrhagic pancreonecrosis; triangles: peritoneal exudate in patients with fatty pancreonecrosis and acute edematic pancreatitis.

lower abdomen were almost identical to blood values and differed significantly from the corresponding values in the bursa omentalis and upper abdomen. These data suggest that significant difference in the EAC/TAC ratios in peritoneal exudate and blood of 8 patients with hemorrhagic pancreonecrosis can result from penetration of the bursa omentalis in the progressive pancreonecrosis and the release of toxic components into the abdominal cavity. In these cases EAC/TAC ratio in the exudate has important diagnostic value indicating the severity of the pathological process.

The appearance of albumin in the exudate in acute pancreatitis indicates disturbances of vascular permeability. The simultaneous decrease in blood albumin is partially due to its release into exudate. If vascular walls are impermeable for albumin, TAC in the exudate does not differ from zero, while if they are absolutely permeable, it should be equal to serum value (if no albumin degradation occurs in the exudate). Comparing ECA values in the blood and exudate one may judge about the disturbances in the vascular permeability and the causes of protein loss. However, in 3 patients with total hemorrhagic pancreonecrosis and progressive enzymatic peritonitis we found zero TAC and EAC in peritoneal exudate. It can be assumed that in these cases albumin passes from the bloodstream but completely degrades in the exudate.

In the majority of cases, albumin passage from the blood into exudate was not accompanied by significant changes in EAC/TAC. Single cases of a sharp decrease in this ratio could be explained by secondary albumin transformation under the influence of toxic exudate components (pancreas proteolytic enzymes, fatty acids, etc). If this is true, then it is possible to evaluate exudate toxicity by comparing EAC/TAC in the blood and exudate. Low EAC/TAC were sometimes accompanied by very low TAC, which can indicate that albumin is catabolized in the exudate.

Thus, fluorescent method makes it possible to assess the loss of blood albumin and the level of toxicemia, spreading of the pathological process outside the bursa omentalis and progression of enzymatic peritonitis in acute pancreatitis. This is important for choosing appropriate therapy for patients with acute pancreatitis. The analysis can be used in express laboratories.

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