Peritonitis - cells, cytokines, and local defense

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Peritoneal dialysis is the first-line renal replacement therapy in Hong Kong (1). Peritonitis is a common and serious complication of continuous ambulatory peritoneal dialysis (CAPD). Although the incidence of gram-positive peritonitis has declined after the disconnect dialysis system became popular, and antibiotic therapy is effective for most episodes, peritonitis remains the major cause of technique failure and conversion to hemodialysis in CAPD patients.

Studies have shown that the resident cells of the peritoneal cavity, including peritoneal macrophages and mesothelial cells, contribute to the initiation, amplification, and resolution of peritoneal inflammation. Although it is widely accepted that resident peritoneal macrophages form the first line of defense against peritoneal infection, recent evidence suggests that the interaction between macrophage and mesothelial cells is pivotal to the activation and subsequent amplification of the peritoneal response to infection. In this issue of the Journal, Chow et al (2) and Guo et al (3) provide further information on this aspect.

In the first article, Chow et al (2) studied 16 cases of peritonitis caused by Mycobacterium tuberculosis, a classic bacteria with intracellular persistence. The authors found that patients with a good therapeutic response had a significantly higher peritoneal fluid macrophage cell count than those patients who failed treatment. In contrast, the lymphocyte count in peritoneal dialysis effluent (PDE) did not affect clinical outcome. It goes without saying that the macrophage is the major cellular component to tackle tuberculous infection. The problem is whether boosting the phagocytic activity - for example, by interferon (4) or vitamin D analogue (5) - can improve the therapeutic response of tuberculous peritonitis.

What is the relevance of this article? Although tuberculous peritonitis is not common, intracellular persistence of bacteria is. Corynebacterium, a diphtheroid gram-positive bacterium, shared a similar cell wall component and several similar biologic properties with mycobacterium (6). Furthermore, mesothelial cells can directly ingest and digest several bacteria (7). Interestingly, Staphylococcus aureus persists in the cytoplasm of mesothelial cells after being ingested (8) - an exceptional means to protect the bacteria from phagocytosis by neutrophil.

However, not all is good with neutrophil in peritonitis. Longitudinal changes in peritoneal transport and ultrafiltration in CAPD patients correlated with cumulated white cell count during peritonitis (9), presumably a result of unchecked mesothelial damage by neutrophil. How does peritoneum control inflammation? In the second article, Guo et al (3) provide some insights in this respect. They observed that soluble intercellular adhesion molecule-1 (sICAM-1) level was reduced in the serum but increased in the PDE of patients with peritonitis. The change was reversible after the treatment of peritonitis, and is distinctly different from spontaneous bacterial peritonitis of cirrhotic patients, whose serum and ascitic fluid sICAM-1 levels are both increased (10). Although the source of sICAM-1 was not studied, the reversal change in serum and PDE did suggest local production by resident peritoneal cells.

What is the role of sICAM-1 inside the peritoneal cavity? In most biologic systems, sICAM-1 is shed from ICAM-1 expression cells by proteolytic cleavage, and secreted into the surrounding fluid. Soluble ICAM-1 binds to lymphocyte function-associated antigen-1 and MAC-1 integrins, and competes with membrane-bound ICAM-1 for activated leukocytes (11). Mesothelial cells produce C-x-C and C-C chemokines that contribute to the intraperitoneal neutrophil migration, which is significantly reduced in the presence of sICAM-1 (12). It seems probable that sICAM-1 forms a local control of the inflammatory cascade, and prevents excessive recruitment of neutrophil and release of reactive oxygen species.

Despite many recent advances, the story of cytokine and cell-cell interaction in peritonitis is far from complete. It should be pointed out that peritonitis is not only a serious problem in clinical dialysis practice, but also an important model in studying several fields of immunology, such as chemotaxis and cell migration. (Hong Kong J Nephrol 2002;4(2):63-64)