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Original Article

Association of serum immunoglobulin G level with peritonitis in patients undergoing peritoneal dialysis: An analytical study

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Abstract

Introduction: Peritonitis is one of the most common complications of peritoneal dialysis. On the other hand, reduced levels of immunoglobulins (Igs), mainly IgG, can increase the risk of infection in various pathologic conditions. Here, we aimed to determine the association of severity and frequency of peritonitis with serum IgG levels in peritoneal dialysis patients.

Methods: 100 patients with chronic renal failure referred to Imam Reza Hospital, Tabriz, Iran, for peritoneal dialysis were included in the study. Serum IgG levels were measured in all of these patients at the beginning of the study and after six months of follow-up. In case of peritonitis, serum IgG levels were also measured, and samples were sent to Imam Reza Hospital laboratory for analysis.

Results: 40 cases (40%) were women, and 60 cases (60%) were men with a mean age of 47 years. 24 cases (24.0%) had at least one episode of peritonitis during the study. Among those with peritonitis, 14 cases (60.9%) had at least one more peritonitis episode in the 6-month follow up. The mean serum IgG levels were 1079 mg/dl and 429 mg/dl at the beginning and after six months of follow up, respectively. The difference was shown to be statistically significant (P = 0.006). There was no correlation between serum IgG level reduction and peritonitis in these patients (P > 0.999).

Conclusion: This study found reduced levels of serum IgG in patients undergoing peritoneal dialysis. However, it was not associated with increased risk of peritonitis in these patients.

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Introduction

Peritoneal dialysis is performed by intradermal fluid injection into the peritoneal cavity 3 to 5 times per day. One of the significant complications of peritoneal dialysis is peritonitis caused by catheter.[1] Peritonitis is usually diagnosed as an increase in the number of peritoneal leukocytes of greater than 100/µl of which more than 50% are polymorphonuclear (PMN) cells. Clinical manifestations of peritonitis include abdominal pain, opaque peritoneal fluid, and fever. The most common causative organisms of peritoneal peritonitis are gram-positive cocci including Staphylococcus spp. originating from the skin.[2]

Peritonitis is one of the most common and important factors limiting peritoneal dialysis leading to persistent peritoneal dialysis and shift into haemodialysis.[3] It has

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been shown that 18% of deaths in patients undergoing peritoneal dialysis are due to peritonitis.[4] Thus, identifying factors contributing to the development of peritonitis can be very important to improve the survival of patients and reduce complications of peritoneal dialysis as a therapeutic approach.

Immunoglobulin G (IgG) is one of the most abundant serum proteins in humans.[5] The decrease in the level of Igs, especially IgG, is associated with an increase in the risk of infection in various pathologic conditions. However, the link between IgG levels reduction and peritoneal dialysis-induced peritonitis has not yet been entirely determined. A recent study showed that low IgG levels in the serum increased the risk of peritoneal dialysis-related peritonitis.[5] In line with that, Coban et al. found that low-dose, continuous IgG injection through intraperitoneal route is safe and effective in shortening the treatment time of peritoneal dialysis-induced peritonitis.[6] However, another study showed that dialysate IgG levels do not predict vulnerability to peritonitis.[7] Further, a study revealed that although the serum levels of IgG2 and IgG4 were low in stable peritoneal dialysis patients, this did not result from increased peritoneal loss, but from decreased synthesis.[8] Thus, a controversy exists over the association of reduced serum IgG and the risk of peritonitis in these patients.

This study aimed to determine the association between the number and frequency of peritonitis in peritoneal dialysis patients with their serum IgG levels.

Methods

Study design and patients: In this cross-sectional analytical study, 100 patients with chronic renal failure undergoing peritoneal dialysis who referred to Imam Reza dialysis center were included. This study was performed at Imam Reza University Hospital, Tabriz University of Medical Sciences, Tabriz, Iran, between February 2015 and 2016 for one year.

Inclusion and exclusion criteria: All patients with chronic renal failure who were a candidate for peritoneal dialysis and referred to Imam Reza Center for peritoneal dialysis were included in this study.

On the other hand, every patient who had nephrotic syndrome, associated autoimmune diseases, a history of kidney transplantation, or immune defects was excluded from this study. Immunosuppressive drug users and patients undergoing haemodialysis were also excluded from this study. If any patient declined to participate in this study, we would exclude him/her from the study.

Study method: One hundred patients with chronic renal failure undergoing peritoneal dialysis were enrolled into this study. Patients' demographic information including age, sex, height, weight, and history of previous illnesses including diabetes mellitus (DM), transplantation, hypertension, peritoneal dialysis initiation time, and cardiovascular disease (CVD) were extracted from patients' records. In addition, symptoms and signs of bacterial peritonitis including abdominal pain, peritoneal fluid opacity, and fever were recorded. Bacterial peritonitis was defined as leukocytosis (> 100 µl) in the peritoneal fluid, plus positive culture or Gram staining of this fluid.

IgG levels were measured in all of these patients at the beginning of the study and after six months of follow-up. In case of peritonitis, serum IgG levels were also measured, and samples were sent to Imam Reza Hospital laboratory for analysis.

All statistical analyses were performed by SPSS software (version 20, IBM Corporation, Armonk, NY, USA). Descriptive data obtained from the study were expressed as mean ± standard deviation (SD), frequency, and percent. McNemar and chi-square tests (the method by Monte Carlo) were applied to compare the mean of qualitative variables in the independent groups. Also, paired sample t-test was used to compare the quantitative variables between two dependent groups.

P < 0.05 was considered to be statistically significant.

Written informed consent was obtained from all of the included patients. The purpose and manner of conduction of the study were fully explained to all of the patients and they were stated that all their personal information would be confidential and would not be mentioned anywhere. No additional cost was received from the patients or their relatives, and it was covered by the study implementer and Vice Chancellor of Tabriz University of Medical Sciences. No further intervention or procedure was performed in this study except one extra blood sample that was taken for serum IgG level assay.

Results

Demographic characteristics: In the present study, 100 patients with chronic renal failure undergoing peritoneal dialysis were included. 40 cases (40%) were women, and 60 cases (60%) were men. Some of the demographic data of the patients are presented in table 1.

Table 1. Demographic data of the included population

Variable	Value
Age (year) (mean ± SD)	47.00 ± 16.23
Duration of peritoneal dialysis (month) (mean ± SD)	28.00 ± 6.90
Prior history of kidney transplantation [n (%)]	12 (12.0)

SD: Standard deviation

The incidence of peritonitis in patients under study: 77 patients (77%) had no peritonitis and 23 cases (23%) experienced peritonitis during the study. Of those who had peritonitis, in the 6-month follow up, 14 cases (60.9%) experienced secondary peritonitis. The mean number of leukocytes in the peritoneal fluid of the patients with peritonitis was 960.00 ± 10.55 of which 78.5% were PMN cells.

Serum IgG levels and the incidence of peritonitis: The mean serum IgG level in 1 case (1%) was more than 850 mg/dl (more than normal), in 25 cases (25%) was lower than 850 mg/dl (lower than normal), and in 74 (74%) cases was normal. The mean IgG levels at the entry time and six months after follow-up were 1079.00 ± 437 mg/dl and 429 ± 364 mg/dl, respectively. We found that the difference between IgG levels at the beginning and end of the study was significant (P = 0.006).

The mean IgG level in patients who experienced secondary peritonitis was 649.26 ± 176.87 mg/dl which was lower than that of patients who did not have re-peritonitis. The difference was found to be statistically significant (P < 0.001). The mean of IgG changes in those who had re-peritonitis was significantly higher than that of those without re-peritonitis (P = 0.011).

There was no statistically significant association between serum IgG levels and peritonitis in this study (P > 0.999).

Discussion

Our results revealed that mean serum levels of IgG were lower in peritoneal dialysis patients with peritonitis than those of without peritonitis. However, there was no association between low serum IgG levels and peritonitis in these patients.

Peritonitis is a severe and important complication of peritoneal dialysis. Similar to the findings of our study, Akman et al. found that IgG subclasses deficiency occurs in patients undergoing continuous ambulatory peritoneal dialysis. Opposed to our findings, they also found that IgG4 subclass values may be associated with the peritonitis rates in these patients.[9]

In accordance with the findings of our study, Lalan et al. showed that low level of gamma globulins (γ-globulins) was a common complication of chronic peritoneal dialysis in infants. However, it did not increase the risk for peritonitis.[10] De Vecchi et al. assessed the clinical importance of peritoneal dialysate IgG levels in peritoneal dialysis patients with peritonitis. The authors of this study failed to show a significant relationship between decreased ascites fluid IgG levels and peritonitis in these patients and stated that dialysate IgG could not be

used as a reliable index to decide which patients were at high risk for peritonitis.[11]

Further, Poyrazoglu et al. performed a clinical study to evaluate the link between low serum and dialysate Ig levels and the frequency of peritonitis in chronic peritoneal dialysis patients. The authors found that low levels of Ig neither in the serum nor the dialysate were associated with occurrence of peritonitis in these patients. However, it may increase the frequency of peritonitis.[12]

On the other hand, a study by Courivaud et al. showed that patients with low levels of IgG were at high risk for peritonitis. The authors showed that the risk of peritonitis in patients with serum IgG levels lower than 6.6 g/l was two times higher than others. It was also determined that hypogammaglobulinemia was associated with an increase in the incidence of haemorrhagic peritonitis (P = 0.003). Finally, Courivaud et al. stated that a decrease in the serum IgG levels could be used as a predictor of peritonitis in peritoneal dialysis patients.[5] The difference between the results of this study and our study could be due to the consecutive manner of the patient selection and prospective nature of their study.

Bouts et al. reported that low levels of IgG increased the risk of peritonitis by more than two times, however, there was no relationship between the first episode of peritonitis and the reduction of IgG levels in peritoneal dialysis patients. According to this study, there was a deficiency of one or more IgG subtypes in all people with renal insufficiency due to uremic conditions, leading to a decrease in IgG levels, and as a result, low Ig levels were associated with frequent peritonitis.[13] The difference observed between this study and the present study may result from the fact that Bouts et al.'s study was performed on children with renal failure[13] and our study included adult population.

In another study by Krediet et al., it was shown that IgG2 and IgG4 levels were lower in peritoneal dialysis patients than healthy subjects, resulting from a decrease in the synthesis of Igs due to uremic conditions. This study also found that low IgG2 levels were associated with the occurrence of peritonitis.[8] The difference may stem from the fact that this study assessed the correlation of specific Ig subtypes with the incidence of peritonitis.

Our study had several limitations. First, we recruited a limited number of patients in this study. In order to better assess the correlation of decrease in the peritoneal Ig levels with the incidence of peritonitis in patients undergoing peritoneal dialysis, studies with larger scales should be performed. Second, we did not assess the correlation of decrease in the specific subtypes of Ig with the incidence of peritonitis that may affect the results of the present study. Third, we could not take into account the effects of malnutrition, obesity, and socioeconomic status. All of these issues should be addressed in the future studies.

Conclusion

As appeared in the discussion part, there is controversy over the association of low serum IgG levels and incidence of peritonitis in peritoneal dialysis patients. In this study, we found that serum IgG levels decreased over the six months period of peritoneal dialysis. However, it did not increase the risk of peritonitis in these patients. More studies are still mandatory for better decision making in clinical practice.

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Authors' Contribution

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Conflict of Interest
Authors have no conflict of interest.

Ethical Approval
Finally, this study was approved by the Medical Ethics Committee of Tabriz University of Medical Sciences.

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