Ultrasonographic findings of patients on continuous ambulatory peritoneal dialysis (CAPD)


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<Abstract>

Between 1989 and 1991, ultrasonograms (US) and CT films of 13 patients undergoing continuous ambulatory peritoneal dialysis (CAPD) were obtained to evaluate splenomegaly, other abdominal splanchnic systems, distribution of CAPD fluid in the abdominal cavity and the condition of the bowel and mesentery.

In this group, there were no cases with splenomegaly, while in hemodialyzed patients, splenomegaly is often demonstrated, as has previously been reported by us. Furthermore there was no statistical correlation between splenic index (SI) and duration of CAPD or platelet count in CAPD patients, though these have been recognized in hemodialyzed patients. There is a definite difference between CAPD and hemodialysis with respect to how the machines are used, so it may be concluded that splenomegaly is caused by hypersplenism resulting from blood cell injury due to mechanical stimulation with, for example, the dialyzer.

Other organs in the abdominal cavity showed no differences between CAPD patients and hemodialyzed patients.

Distribution of CAPD fluid in the abdominal cavity was different in each case, and in addition, the contact surface between it and the bowel or mesentery was localized. Furthermore, measurement of mesentery thickness tended to be affected by peristalsis, and differed according to various sites in the same patient. Therefore, mesentery thickness measured by US as an index of CAPD efficiency must be evaluated cautiously.

Introduction

Although splenomegaly of hemodialized patients has been evaluated by several authors1), exact origin cannot be defined till now. We considered that it might be caused by hypersplenism occurring to destruct injured blood cells which were produced by mechanical stimulation, for example dialyzer2). To confirm it, we need to compare spleen of hemodialyzed patients with one of patients on continuous ambulatory peritoneal dialysis (CAPD) using no machine.

Recently some authors have reported usefulness of ultrasonography (US) in judging thickness of mesentery as an index of efficiency of CAPD (especially ultrafiltration)3). But we have sometimes experienced difficulty to measure mesenterial thickness in usual examination.

In this article, we would like to mention about difference of abdominal splanchnic system between hemodialyzed patients and CAPD one, mainly dealing with spleen, furthermore to maintain that there is important pitfalls in judging mesenterial thickness from US findings.

Materials and Methods

US findings of thirteen CAPD patients in Masuko Memorial Hospital were evaluated. The patients group comprised 12 CGN (chronic glomerulonephritis) and one DMN (diabetic nephropathy), 11 males and 2 females (aged 27-65; average 47.9 years, treated periods under CAPD 1-4.5 years; average 1.8 years). Quantity of CAPD fluid was 1.5 liter in 10 patients and 2 liter...
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in 3 patients. US and CT study in abdomen and pelvis of this group were performed two or three times a year.

US system was Tohshiba electric scanner 100-A with 3.5 MHz convex prove, and CT system was Tohshiba TCT 80-A.

We judged splenomegaly by splenic index (SI): SI was calculated from the product of A and B, which consisted of length from splenic hilum to splenic anterior surface (A) and one from it to splenic lateral surface (B). The line A and B crossed rectangularly. The SI values more than 20 square centimeter were judged as splenomegaly.

Relationship between SI and CAPD period, number of platelets and white blood cells were evaluated. Subsequently US and CT findings of CAPD distribution in abdominal space, bowel and mesentery were evaluated.

Results

There was no case of splenomegaly (SI 7.2-18; average 10.2). And yet no statistical relationship between SI and CAPD period, number of platelets and white blood cells was demonstrated. Renal size had decreased and echogenecity of renal parenchyma elevated. Acquired renal cysts had been shown in about half cases. Polyp and calculus in gall bladder was observed in each a case.

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<thead>
<tr>
<th>No. of Cases</th>
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+mild, ++moderate, ###massive

Condition of CAPD fluid distribution in abdominal cavity was shown in Table. Massive collection of it in pelvic space was recognized in all cases, while distribution of it varied widely in Morison’ pouch, surface of liver and spleen, and flank (Fig. 1). A contacting area between CAPD fluid and bowel or mesentery, being considered as an important factor of CAPD efficiency, was large in flank (Fig. 2). And we were impressed that those contacting surface was relatively localized.

There was such a tendency that the longer CAPD period had a patient, the more his mesenterial thickness was, especially in bowel surface (Fig. 3). On the other hand, mesenterial thickness was different according to various sites in the same patient (Fig. 4). Furthermore evalua-
tion of it was apt to be affected by bowel peristalsis frequently (Fig. 5).

Discussion

It is said that splenomegaly observed in hemodialyzed patients is similar to spleen with congestion, which may be usually caused by longstanding hemodialysis. But such a hypothesis has not been defined yet. We also have reported that an extent of splenomegaly of hemodialyzed patients had statistical correlation with periods of hemodialysis and number of platelets (Fig. 6). On that report we considered that mechanical stimulation, for example dialyzer, might injure blood cells and then those cells would be destructed by spleen, subsequently splenomegaly would be caused in result. In this paper, spleen of CAPD patients using no machine was compared with one of hemodialyzed patients to confirm our hypothesis. As a result of this study, no splenomegaly was observed in CAPD patients, furthermore there was no statistical correlation between SI and CAPD periods or number of
platelets. Those facts may prove that mechanical stimulation to blood cells is one of the cause of splenomegaly though average of CAPD periods is not so long: 1.8 years. (By the way, as for the group whose hemodialyzed duration ranged from 1 to 4 years (average 1.9 years) in our previous report\textsuperscript{2)}, splenomegaly was demonstrated in 7 cases of 27 patients.) But following observation more than 3 years in the future will be needed to confirm it more certainly.

Changes of other organs showed little difference compared with those of hemodialyzed patients\textsuperscript{2}). For example kidney, parenchyma of it showed elevated echogenecity with obliteration of border between renal parenchyma and central echo complex, furthermore its size had decreased and acquired cystic disease of kidney (ACDK) were demonstrated in various degree.

Sclerosing peritonitis is well known as most serious and popular complication in CAPD patients\textsuperscript{3,4}). And US changes in it is also well known and comprise increased small bowel peristalsis, tethering of bowel to the posterior abdominal wall, intraperitoneal echogenic strands and membrane formation. Therefore US is a rapid and sensitive means of demonstrating the feature of sclerosing peritonitis in CAPD patients\textsuperscript{3}). Furthermore it was said by some authors that mesenterial thickness was a good index of CAPD efficiency without sclerosing peritonitis and US was a good modality to evaluate it\textsuperscript{3}). However, we considered there was some pitfalls mentioned below and it is necessary to use it carefully as an index. Because distribution of CAPD fluid had differences among individuals and contacting surface was relatively localized, there is a possibility of difference of measuring site of mesenterial thickness in case by case. Meanwhile mesenterial thickness was different according to various sites in the same patient and measurement of it was apt to be affected by bowel peristalsis.

Therefore evaluation of mesenterial thickness is given to be performed subjectively. After this we are going to investigate how to objectify evaluation of mesenterial thickness measured by US.

**Conclusion**

1. Splenomegaly in CAPD patients was demonstrated in no case while it had been highly observed in hemodialyzed patients.

2. Therefore hypersplenism caused by mechanical stimulation to blood cells was considered as one of the origin of splenomegaly.

3. Though there was such a tendency that the longer period of CAPD had a patient, the more was his mesenterial thickness, it was difficult to evaluate objectively mesenterial thickness as an index of CAPD efficiency.

**References**


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＜和文要旨＞

透析患者における腹膜の頻度が高いことが知られているが、その原因は未だに明らかにされていない。我々はこれまで
に腹膜の原因が透析中に用いられる dialyzer などの機械的刺激により傷害された血球の処理の結果として生じる腹
膜亢進症の可能性があると報告した。また、最近の報告では持続的腹膜透析（CAPD）患者の透析効率の指標として超
音波による腸間膜の観察が有用であるとの報告がみられる。しかし、日常の超音波検査において、腸間膜の厚さの評
価に矛盾を感じることがしばしば経験される。今回、腸間膜の原因を探るために、機械を用いない CAPD 患者の腸間
膜を検査し比較した。さらに、超音波で腸間膜厚を評価する際の問題点について検討した。

1989 年から 1991 年の間に、東京記念病院で CAPD を受けている患者 13 名に対し、1 年に 2 ～ 3 回の超音波およ
び CT 検査を施行し、その結果を分析した。CAPD 患者では腸間膜の 1 例も認められなかった。平均 CAPD 歴が 1.8
年と検査対象となっている透析戦に比べて短いための影響を否定できないものの、機械的刺激が腸間膜の原因の一つで
ある可能性が示唆された。ちなみに、我々の報告した透析患者の腸間膜の頻度は 87 名中 21 名であるが、平均透析歴 1.9
年の群 27 名では 7 名に腸間膜が認められた。腎や胆囊等の他の腹部臓器に関しては CAPD と透析患者の間に相違は認
められなかった。CAPD 液の腹腔内分布状態は個人的にばらつきが大きく、CAPD 効率の重要な決定因子と考えられ
る腸管および腸間膜と液との接触部は側腹部が主体で比較的限られていた。さらに腸間膜の厚さの評価は同一症例で
も部位により異なり、腸管運動の影響を受けやすかった。このため、腸間膜の厚さの測定部位が個人によりあるいは
時により大きく異なってくる可能性がある。その結果、腸間膜の厚さを CAPD 効率の客観的標指として利用するには、
かなり慎重かつ工夫が必要であると考えられた。