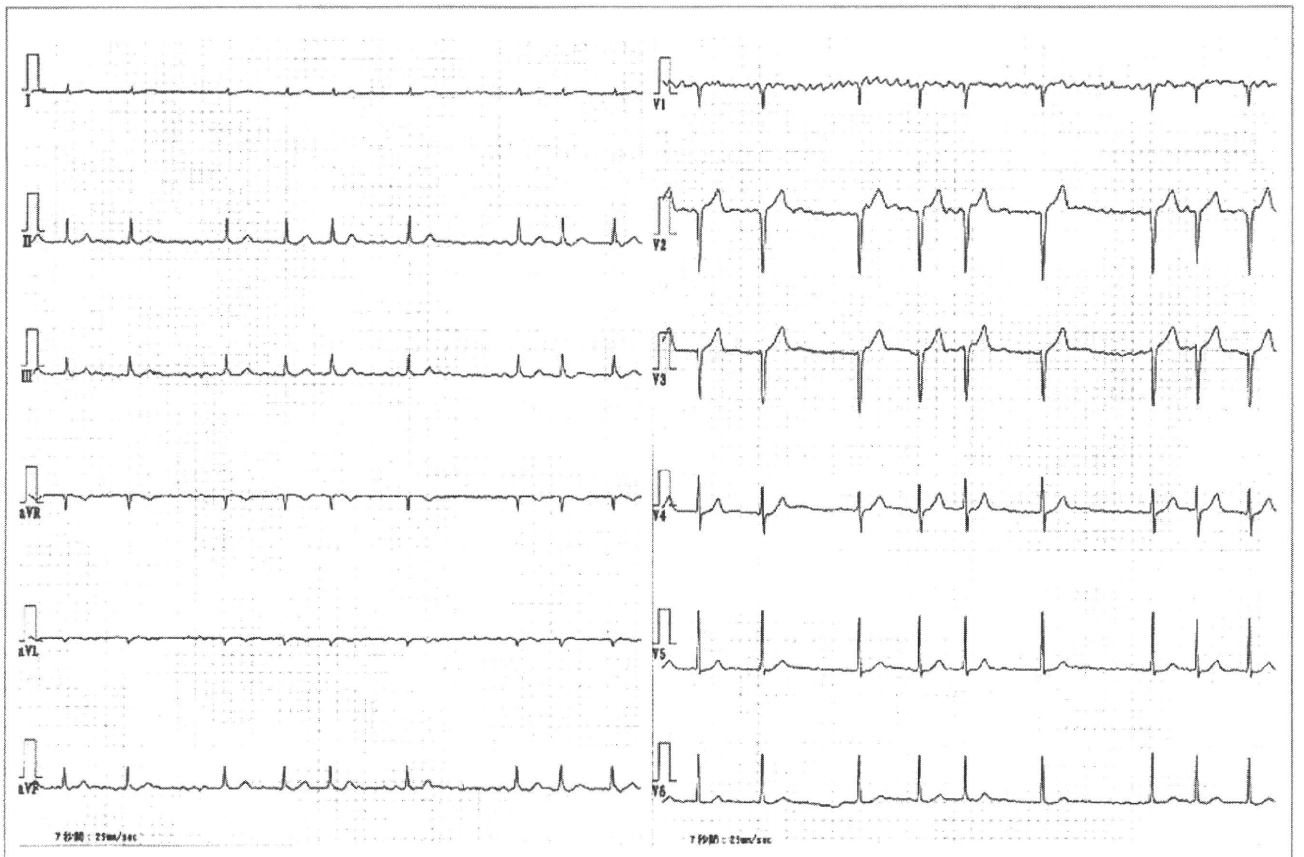

心房細動と前壁中隔の陳旧性心筋梗塞があり，低電位を呈している

図10　症例2の心電図

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Original Article

Mao-to Prolongs the Survival of and Reduces TNF-α Expression in Mice with Viral Myocarditis

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Goal of this study was to evaluate effects of Mao-to on development of myocarditis induced by encephalomyocarditis (EMC) virus in mice. Mice were randomly divided into five groups. Group N included uninfected controls ($n = 18$), while group A, B and C underwent intraperitoneal injection of EMC virus. Group A was administered oral saline from day 0 to day 4. Group B was administered oral Mao-to ($500\,mg^{-1}\,kg^{-1}\,day^{-1}$) from day 0 to day 4. Group C was administered Mao-to from day 2 to day 6. Group D was administered Mao-to from day 5 to day 10. Treated mice were followed for survival rates during 2 weeks after infection. Body weight (BW) and organ weights including heart (HW), lungs, thymus and spleen were examined on days 4, 6 and 14. Survival rate of group C (36.4%) was significantly improved compared with group A, B or D (0% of each, $P < 0.05$). HW and HW/BW ratio in group C was significantly ($P < 0.05$) lower than those in group A, B or D. Viral titers of hearts were significantly different among groups A, B and C. Cardiac expression in tumor necrosis factor-α (TNF-α) was significantly reduced in group C in comparison with group A, B or D on day 6 by immunohistochemical study. Administration of Mao-to starting on day 2 improves mortality resulting from viral myocarditis in mice with reduced expression of cardiac TNF-α. These findings suggest that timing of Mao-to is crucial for preventing cardiac damage in mice with viral myocarditis.

Keywords: Mao-to – viral myocarditis – tumor necrosis factor-α

Introduction

Myocarditis is an important cause of cardiomyopathy in young patients (1). Therapeutics for myocarditis have been restricted to supportive care including basic medications (2). Randomized trials of immunosuppressive agents have failed to show a benefit (3). Immunomodulative agents have been tried with limited effects (4). In severe cases, heart transplantation presents the only therapeutic option (1). Anti-inflammatory and anti-viral agents are needed to improve outcomes in these patients.

Mao-to (Ma-Huang-tang in Chinese) is traditionally used in Japan and China for treatment of influenza-like illness (high fever, headache, pain and cough) since ancient times. Component herb names (botanical names) of Mao-to are as follows: *Ephedra Herba* (stem of *Ephedra Sinica* Stapf), *Cinnamomi Cortex* (bark of

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Cinnamomum cassia Blume), *Armenicae Semen* (semen of *Prunus Armeniacae* Linne) and *Glycyrrhizae Radix* (root of *Glycyrrhizae uralensis* Fisher) (5). *Ephedra Herba* was reported to show the *in vitro* anti-influenza viral effects and augments the production of inflammatory cytokines including interleukin-6 and interleukin-1 (6,7). Moreover, *Cinnamomi Cortex*, which contains Mao-to, suppress IL-1α production in the influenza virus-infected mice (8). Moreover, Mao-to has been studied for its anti-viral and anti-autoimmune effects (9,10). Recently, anti-pyrulent effect of Mao-to was reported in patients with influenza infection (6). However, the effects of Mao-to in viral myocarditis have not been studied. Inflammatory cytokines are involved in the pathogenesis of myocardial injury in viral myocarditis.

Tumor necrosis factor-α (TNF-α) is a proinflammatory cytokine (11) that plays a crucial role in the initiation and continuation of inflammation and immunity (12). This cytokine has been implicated in the pathogenesis of cardiovascular diseases, especially in viral myocarditis. Our previous work showed that cardiac expression of TNF-α mRNA is increased in a mouse model of viral myocarditis (13). Over production of TNF-α is generally considered to be harmful to the cardiovascular system, because systemic administration of TNF-α results in myocardial depression (14) and cardiomyopathy (15). Cardiac-specific over-expression of TNF-α has been reported to cause severe myocarditis in mice (16,17).

Therefore, we hypothesized that Mao-to would modify viral myocarditis through anti-viral and anti-inflammatory effects and that cardiac expression of TNF-α was studied as an indicator of myocardial damages.

Methods

Mice

Eight-week-old C3H female mice (Charles River, Japan) were used in the experiments.

Virus

A myocarditic variant of encephalomyocarditis (EMC) virus was obtained from Y. Seto, Keio University, Tokyo, Japan. Encephalomyocarditis virus was cultured and purified followed by previous report (18). Animals were inoculated intraperitoneally with 500 plaque-forming units of EMC virus in 0.1 ml of saline.

Chemicals

Mao-to which was supplied by Tsumura Co. (Tokyo, Japan) was dissolved in distilled water, and diluted with distilled water to the appropriate concentration. HPLC finger print pattern of Mao-to is shown in Fig. 1. Mao-to solution at the dose of $500\,mg^{-1}\,kg^{-1}$ was administered orally once daily to the mice. The dose of Mao-to was based on the findings in previous reports (19,20). The control mice were given saline.

Treatment Protocol

A total of 135 mice were assigned randomly to five groups. Mice in groups B and C received Mao-to 10 mg per mouse in 0.1 ml saline ($500\,mg^{-1}\,kg^{-1}\,day^{-1}$) once daily for 5 days. Group A was administered with 0.1 ml saline from day 0 to day 4. Group B was administered with 0.1 ml Mao-to from day 0 to day 4. Group C was administered with 0.1 ml Mao-to from day 2 to day 6. Group D was administered 0.1 ml Mao-to from day 5 to day 10. Group N was the uninfected control group. The survival rate of each group was monitored during the observation period. Body weight and organ weight, and histopathologic changes in the heart were examined on day 4, 6 and 14 after infection.

Pathologic Examination

The heart and other organs were weighed. Body weight (BW) also was recorded. One half of each organ was fixed in 10% buffered formalin and stained with hematoxylin-eosin; the other half was frozen in embedding compound at −120°C for immunohistochemical studies. Transverse sections of ventricular myocardium were graded for severity of necrosis and mononuclear cell infiltration on a scale from 1 to 4 as follows: grade 1, lesions involving < 25% of the ventricular myocardium; grade 2, lesions involving 25-50% of the myocardium; grade 3, lesions involving 50-75% of the myocardium and grade 4, lesions involving 75-100% of the myocardium. Tissues were evaluated blindly by an experienced pathologist who was familiar with grading murine viral myocarditis and had no knowledge of the study design.

Measurements of Myofiber Diameter

In the lateral wall of the left ventricle, myocardial fiber diameter was determined by measuring the shortest diameter at the level of the nucleus of 50 myocardial fibers from each group with an ocular micrometer in the stained cross-sectional areas.

Immunohistochemical Examination

To visualize the presence and anatomic localization of TNF-α within the myocardium, immunohistochemical studies were performed using an avidin biotin complex method (Vectastain ABC kit, Vector Laboratories, Burlingame, CA) as previously described (21). To minimize the background staining, all sections were first blocked with normal goat serum for 20 min at room temperature.

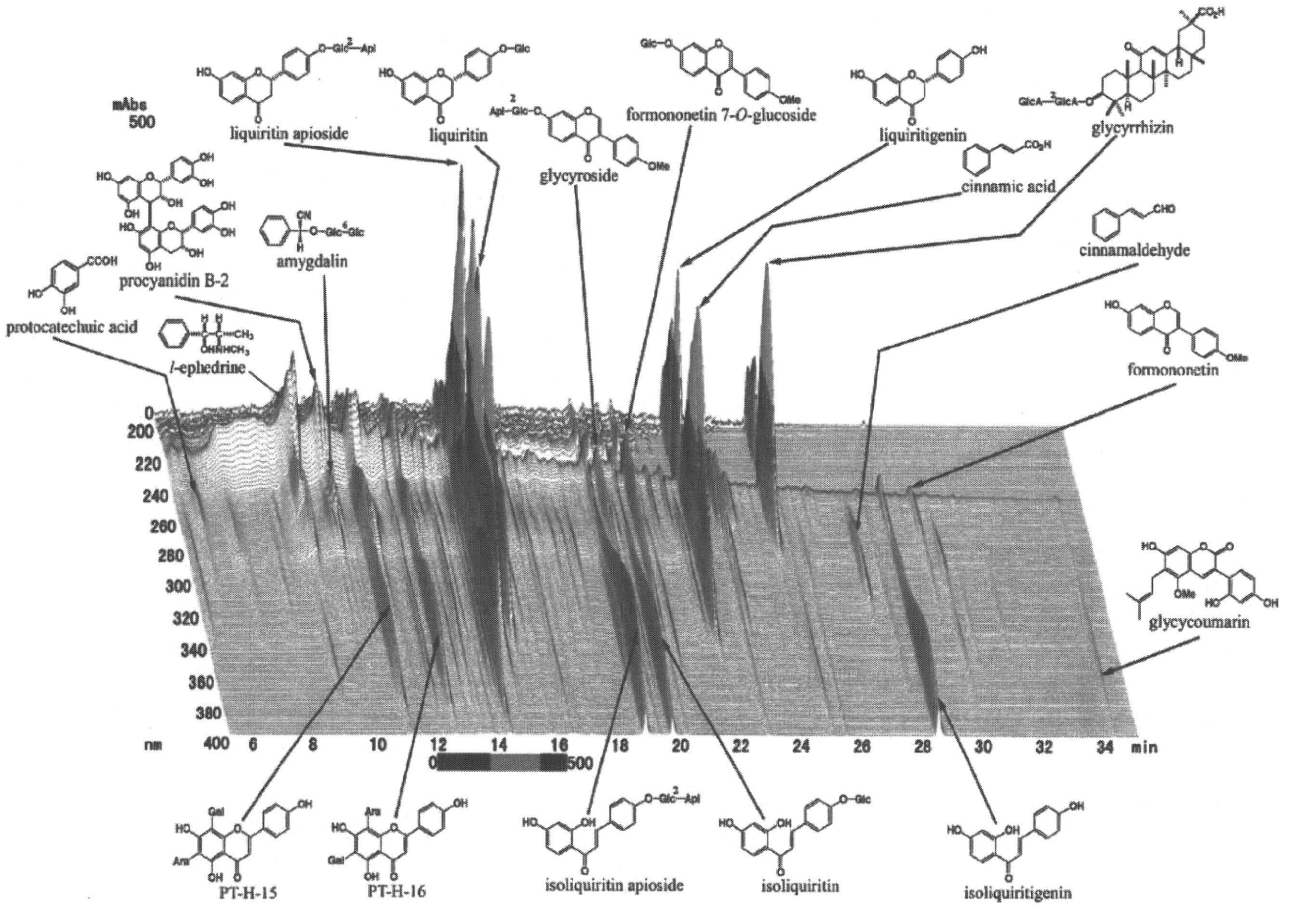

Figure 1. HPLC finger print pattern of Mao-to. HPLC conditions: Pulp: LC-10AD vp (Shimadzu, Japan); column: TSK-GEL ODS-80TS column (250 × 4.6 mm; Tosoh, Japan); mobile phase: 0.05 m AcONH4 (pH 3.6) (5).

Next, the slides were incubated with an antibody directed against murine TNF-α (Alpha-Diagnostic International Inc., San Antonio, USA). Sections were counterstained with hematoxylin and eosin. TNF-α immunostaining was graded as follows: both nuclear and cytoplasmic staining 4; strong cytoplasm staining 3; moderate cytoplasmic staining 2 and slight cytoplasmic staining 1.

Viral Titer in Heart

The EMC viral titer in the individual hearts was determined in terms of the viral cytopathic effects, and is expressed as the tissue culture mean infectious dose (TCID50). The hearts on day 4 after the inoculation ($n = 3$ of each group) were homogenized in 2 ml of MEM. After the centrifugation, the supernatants were added into 96-well microtiter plates containing human amnion cells in the MEM supplemented with 10% fetal calf serum as described previously (21). The microtiter plates were daily observed for 5 days to find the appearance of any cytopathic effects.

Statistics

Data are reported as means ± SD. The Kaplan–Meier curves were generated to analyse differences in survival. The differences in scores of myocardial damages were examined by two-way analysis of variance to reveal the combined effects of two different agents. Scheffes' *F*-test and Bonferroni/Dunn analysis were used for confirmation. A level of $P < 0.05$ was considered statistically significant.

Results

Prolonged Survival

Survival rates on day 7 were 18.2% in group A, 18.2% in group B, 63.6% in group C and 23.3% in group D. The survival rates on day 14 were 0% in group A, 0% in group B, 36.4% in group C and 0% in group D. The survival rate in group C was significantly higher than those in groups A, B or D ($P < 0.05$, Fig. 2). Thus, treatment with Mao-to starting on the day 2 after EMC

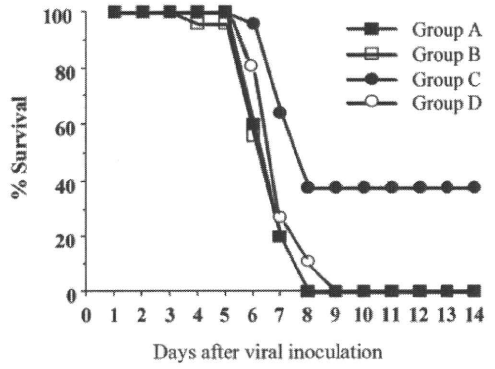

Figure 2. Survival in mice after viral inoculation. survival was significantly ($P < 0.01$) improved in the group C as compared with mice in groups A, B or D. Group A: administered with 0.1 ml saline starting on day 0 to day 6, group B: administered with 0.1 ml Mao-to starting on day 0 to day 4, group C: administered with 0.1 ml Mao-to starting on day 2 to day 6, group D: administered 0.1 ml Mao-to from day 5 to day 10.

virus improved the survival, although Mao-to given earlier or later was not effective in this regard.

Reduced Heart Weight

The results are shown in Fig. 3. The BW in group A and B on day 6 after virus inoculation was significantly ($P < 0.05$) lower than that in group C. The HW/BW ratio in group A on day 4 was elevated compared with that of groups B and C ($P < 0.05$). The HW and HW/BW ratio in group C on day 6 after virus inoculation was significantly ($P < 0.01$) lower than that in group A. Additionally, the HW/BW in group C on days 4 and 6 were significantly ($P < 0.01$) lower than those in group B. However, the HW and HW/BW ratio in group C on days 4, 6 and 14 did not differ significantly from those of the group N. In group D, HW and HW/BW ratio on day 6 were significantly higher than those in group N.

Decrease of Lung Congestion

The lung weight (LuW)/BW ratio on days 4 and 6 was increased in groups A and B compared with group N. The LuW/BW ratio on days 4 and 6 were significantly reduced in group B and C vs. group A. In group C, the LuW/BW ratio on day 4 was significantly lower than that in group B, but that on day 6 was not significantly different than group B. In group D, LuW/BW ratio on day 6 was significantly higher than that in group N.

Reduction of Thymus Weight and Enlarged Spleen

The thymus weight (ThW)/BW ratio in groups A, B, C and D on day 6 was significantly ($P < 0.05$) lower than in the group N and the spleen weight (SpW)/BW ratios in groups A, B and C on days 4 and 6 were significantly ($P < 0.05$) higher than in group N (Fig. 4). Although the ThW/BW ratio on day 6 in group C did not differ from that in group A, the SpW in group C on day 6 was significantly ($P < 0.05$) higher than in groups N and A. In group D, ThW/BW ratio on day 6 was significantly lower than that in group N and SpW/BW was significantly higher than that in group N.

Decreased Myocardial Diameter and Myocardial Damage

The myocardial diameter was significantly smaller in group C than that in group A and B on day 6, as shown in Fig. 5. Myofiber diameter in group A was significantly larger than that in group N. The scores of myocardial necrosis and mononuclear cell infiltration were significantly reduced in group C compared with groups A, B and D on day 6 (Fig. 6A).

Suppression of Expression of TNF-α in Heart

Localized expression of TNF-α in the heart is shown in Fig. 6B. Endothelial cells and myofiber were positive for TNF-α in groups A and B on days 4 and 6. Myofibers from group C were less positive than those from groups A and B on day 6. The grading of TNF-α immunostaining on day 6 was relatively lower in group C compared with those in group A, B or D ($P < 0.05$, $n = 3$ of each, Fig. 4). In addition, comparative expression of cardiac TNF-α mRNA in the group C were significantly less than in the groups A, B or D (Fig. 7).

Viral Titer in Heart

On day 4, viral titer in the hearts was not significantly elevated in the Mao-to groups compared with that in the group A (group B; 3.3 ± 0.8 TCID/mg, group C; 3.0 ± 0.7 TCID/mg vs. group A; 3.5 ± 1.0 TCID/mg), although the titer in group C was slightly lower than that in group A.

Discussion

At present, we have shown that Mao-to, administered 2 days after viral inoculation in C3H/HeJ mice, improves survival rates, and reduces both myocardial necrosis and mononuclear cell infiltration in mice with viral myocarditis. Accordingly, SpW/BW ratios were elevated in these mice. However, the administration of Mao-to at the same time as virus inoculation did not influence survival or myocardial destruction. We conclude that Mao-to has an anti-viral effect on EMC viral myocarditis in this mouse model *in vivo* and involves the modulation of early immune responses with the reduction of cardiac TNF-α

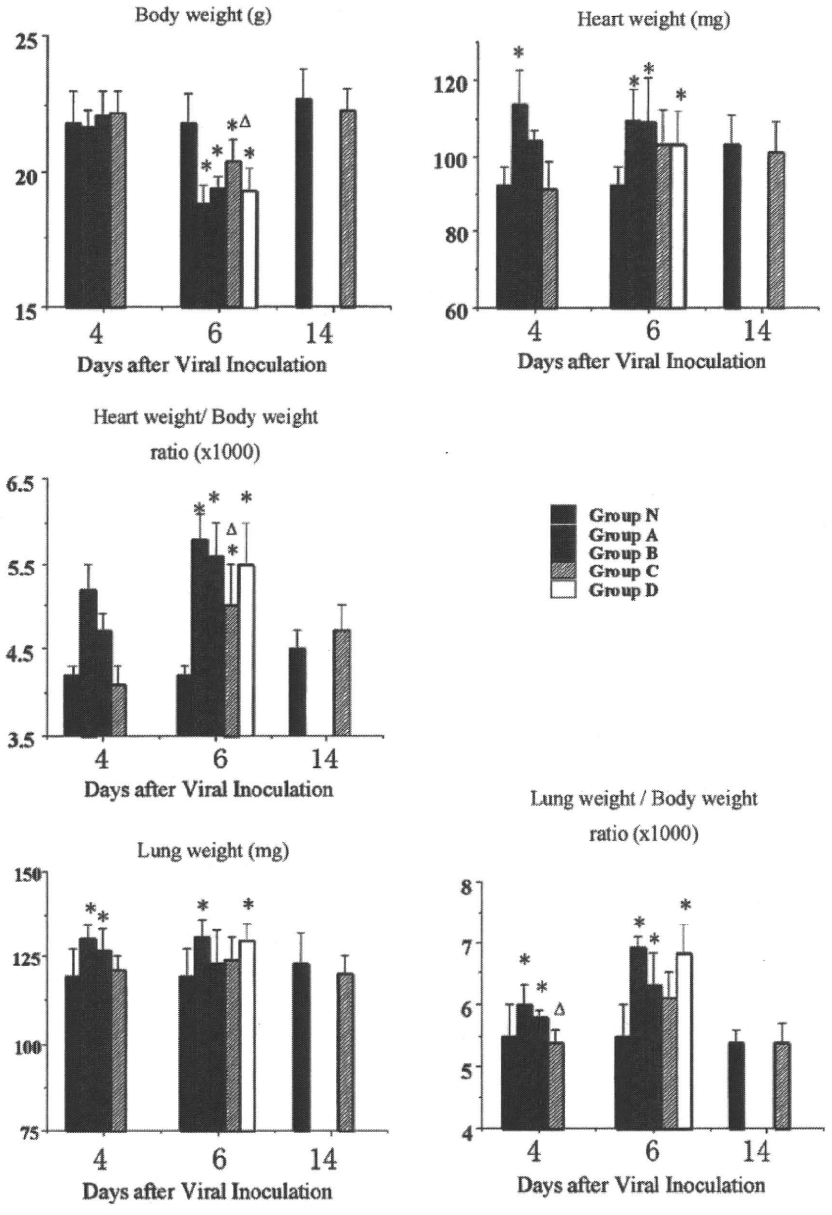

Figure 3. Heart and lung weight in murine viral myocarditis. Heart weight, heart weight/bodyweight ratio and lung weight/body weight ratio on day 6 was significantly reduced in group C compared with group N. Abbreviations; N: uninfected control mice, A: administered with 0.1 ml saline starting on day 0 to day 6, B: administered with 0.1 ml Mao-to starting on day 0 to day 4, C: administered with 0.1 ml Mao-to starting on day 2 to day 6. $*P < 0.05$ vs. group N, $\Delta P < 0.05$ vs. group A.

mRNA, although the viral titer of hearts were not significantly changed.

The LuW/BW ratio reflects the degree of lung congestion. The two days later administration of Mao-to and virus as group C leads to a significant reduction in LuW/BW on day 6. The reduction of LuW/BW ratios in group B are considered to reflect an improvement in congestive heart failure due to viral myocarditis. The effect of Mao-to on histopathological changes depends on the timing of administration. As noted, when administered two days following viral inoculation, Mao-to led to significant reduction of myocardial necrosis and mononuclear cell infiltration.

The reasons why oral administration of Mao-to was started on 2 days after virus inoculation, should be discussed. Our previous data showed that the both peaks of serum TNF-α and interferon were identified on day 2 after viral inoculation in this murine model (21). Neutralizing antibody titer was confirmed on day 4. Oral administration of Mao-to was effective in patients

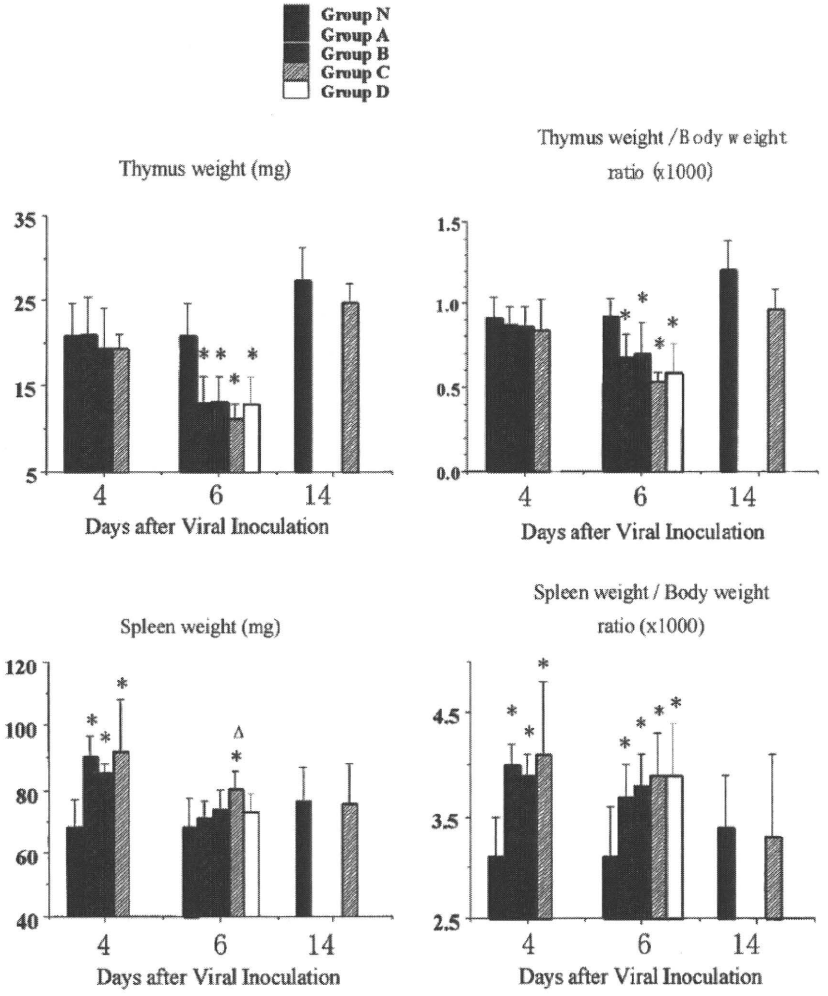

Figure 4. Thymus and spleen weight in murine viral myocarditis. Thymus weight in Mao-to-treated groups A, B, C and D were significantly reduced compared with group N on day 6. Spleen weight/body weight ratio were significantly increased in group C compared with group N. Groups as are described in Fig. 2. $*P < 0.05$ vs. group N, $\Delta P < 0.05$ vs. group A.

already infected with influenza virus (10). Moreover, Mao-to has been reported to show an *in vitro* anti-viral effect (6). These reports suggest that the starting time of administration, 2 days after virus inoculation, could suppress these reactions instead of other days after virus inoculation.

The reasons why Mao-to administration starting on day 0 (group B) did not prolong the survival should be discussed. It is known that Mao-to increase the blood pressure, heart rate and cardiac output and decrease the total peripheral resistance (22). From day 0 to 4, the main course of viral myocarditis is the infection of viral genome to myocytes, not the secondary immune cell infiltration in the heart. Mao-to administration on day 0 to 4 is possible to make myocyte damages worse by inducing excessive contraction of infected myocytes.

TNF-α is secreted primarily by myocytes and macrophages after injury (23). Elevation of TNF-α contributes to the extent of ventricular dysfunction as shown in TNF-α knockout mice (24). Previous studies have demonstrated that cardiac-specific expression of TNF-α results in myocardial inflammation, cardiac hypertrophy, progressive dilatation and increased apoptosis, which leads to heart failure and death (25). TNF-α may play an important role in modulating left ventricular dysfunction (26).

The present study also suggests that Mao-to may play a role in cytokine regulation of host defense mechanisms against viral myocarditis in mice *in vivo*. Comparative studies on anti-immune effects of Mao-to were reported. Mao-to prevents passive cutaneous anaphylaxis and also inhibits histamine and leukotriene C4 release from the mast cells (27). These suppressive effects may be due to the interaction of its components such as *Ephedra Herba* and *Cassia Twig*. The former was showed to suppress interleukin-1 and 6 and the latter suppresses interleukin-1α

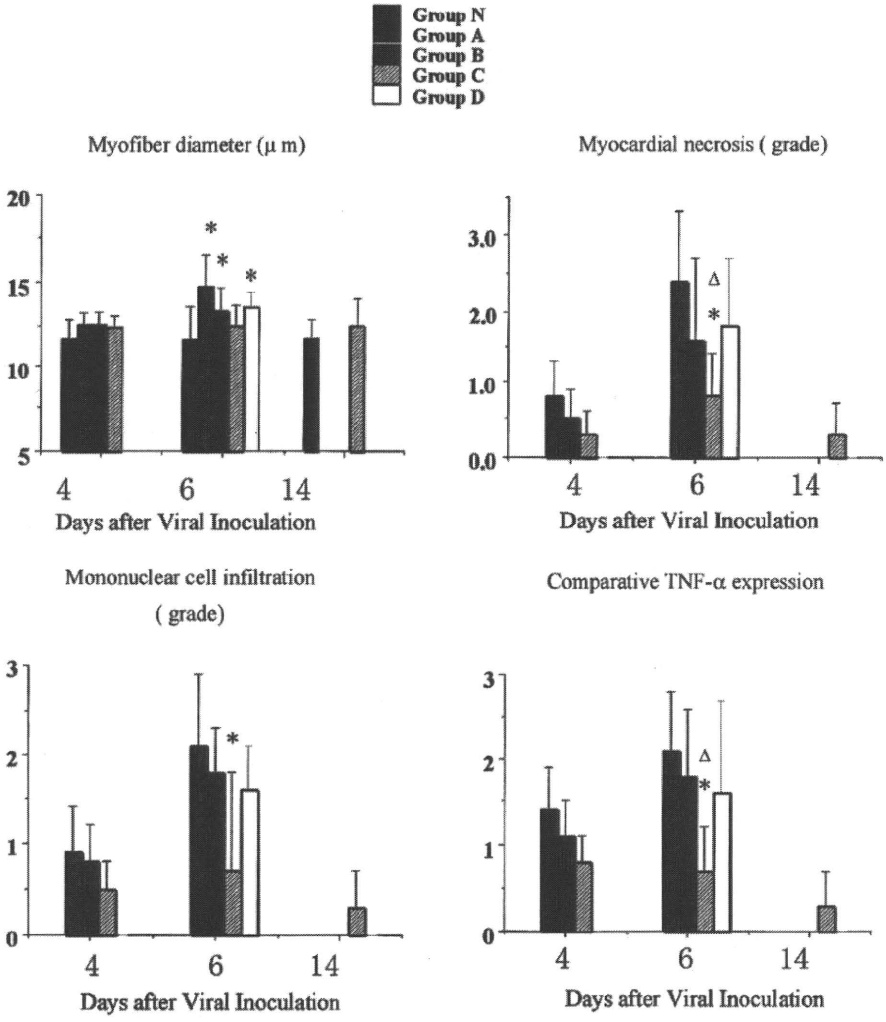

Figure 5. Myofiber diameter, cardiac histopathologic scores and grading of cardiac expression of TNF-α protein in murine viral myocarditis. Groups as are described in Fig. 2. Grades of severity of necrosis and mononuclear cell infiltration on a scale from 1 to 4 are as follows: grade 1, lesions involving <25% of the ventricular myocardium; grade 2, lesions involving 25-50% of the myocardium; grade 3, lesions involving 50-75% of the myocardium; and grade 4, lesions involving 75-100% of the myocardium. ND; not determined, $*P < 0.05$ vs. group N, $\Delta P < 0.05$ vs. group A.

(6–8). The importance of neutralization in early anti-viral host defense is well appreciated. The anti-viral mechanism of Mao-to in mice may be to elicit these immune responses and to enhance immune cell function rather than to directly interfere with viral replication (10). Indeed, Mao-to was reported to be effective in the suppression of hepatitis virus in combination with interferon beta (6). Recently, *Cinnamomi Cortex*, a component of Mao-to, was reported to inhibit nuclear factor-kappa B (NF-κB) activation in mice (28). NF-κB is the most regulator of the innate immune response (29). Therefore, Mao-to might contribute to the regulation of innate immunity *in vivo*.

An additional reflection of immunomodulation by Mao-to was the enlargement of lymphoid organs, including spleen in group C. Although the precise mechanisms of Mao-to effect are not addressed by the examination of organ weights, the increased SpW/BW and ThW/BW ratios may be related to the immunomodulatory effect of Mao-to (21,26).

In summary, oral administration of Mao-to two days after inoculation is beneficial to mice infected with the EMC virus and with subsequent active viral myocarditis. The present study supports the observations that Mao-to promotes temperately adaptive immune responses in spleen and heart muscle, and the consequent attenuation of viral replication when Mao-to is administered two days after the virus inoculation. However, Mao-to treatment must be concomitant with other treatment modalities. It would be better to further clarify the potential activities of Kampo medicine as well as Mao-to in basic investigations or clinical trials (30-32). Additional experiments are underway to explain specifically the mechanism by which Mao-to protects against viral myocarditis.

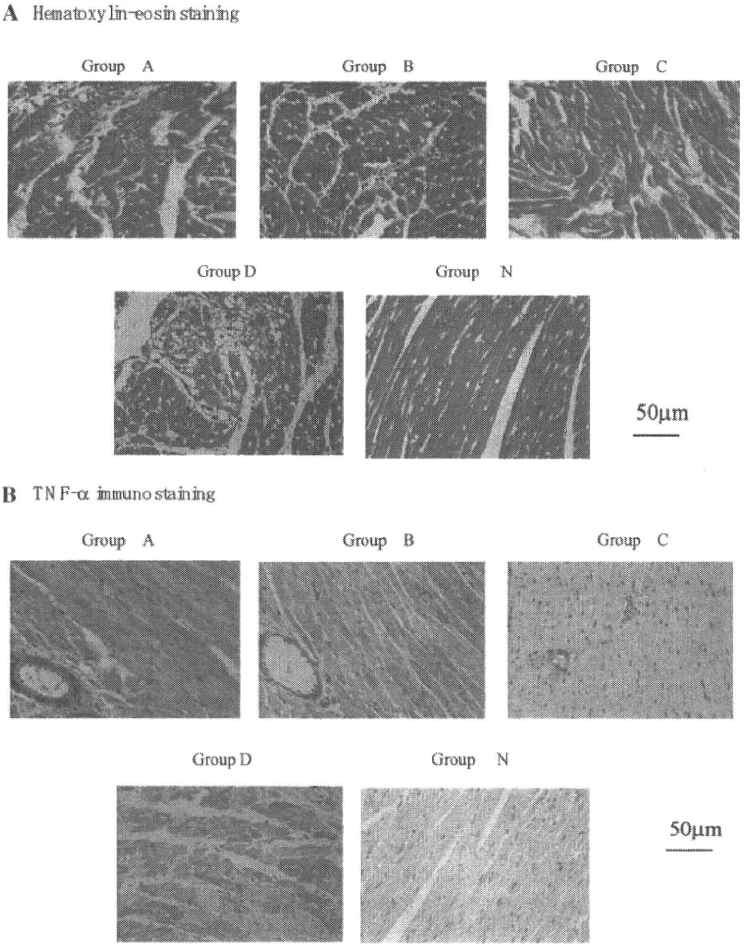

Figure 6. A. Pathologic findings of the heart in mice after viral inoculation. Myocardial necrosis and immune cell infiltration was observed on day 6. However, myocardial necrosis in group C on day 6 was reduced compared with the groups A, B and D. **B.** Immunohistochemical findings showed cardiac expression of TNF-α in the heart. Myofibers in the group C were less positive than in the groups A, B or D. Group A: administered with 0.1 ml saline starting on day 0 to day 6, group B: administered with 0.1 ml Mao-to starting on day 0 to day 4, group C: administered with 0.1 ml Mao-to starting on day 2 to day 6, group D: administered 0.1 ml Mao-to from day 5 to day 10.

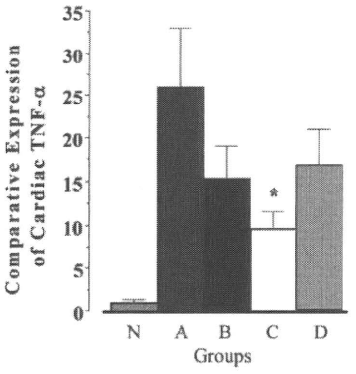

Figure 7. Comparative expression of cardiac TNF-α mRNA. This expression in the group C were significantly less than in the groups A, B or D. Group A: administered with 0.1 ml saline starting on day 0 to day 6, group B: administered with 0.1 ml Mao-to starting on day 0 to day 4, group C: administered with 0.1 ml Mao-to starting on day 2 to day 6, group D: administered 0.1 ml Mao-to from day 5 to day 10.

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VI. 東日本大震災被災地避難所配布

≪一般救護者用災害時高齢者医療マニュアル≫
試作版

～被災されたお年寄りを救うために、

すべての方々が活用できる

一般救護者用

災害時高齢者医療マニュアル

（試作版）

厚生労働省　長寿科学総合研究事業
「災害時高齢者医療の初期対応と
救急搬送基準に関するガイドライン」
研究班

社団法人　日本老年医学会

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はじめに

【本マニュアル作成にあたっての経緯】

本国は地震、台風、津波などの様々な災害が多い国です。その災害時において、被災された高齢者の方々に対する医療は非常に重要です。特に避難所での生活に入らざるを得なかった高齢者の方々は、生活環境が一変し多くの精神的・身体的ストレスを受けます。さらに、もともとかかりつけていた慢性疾患（高血圧、糖尿病、脳心疾患なども含めて）の管理を継続しづらくなってしまいます。

そこで厚生労働省・厚生労働科学研究費補助金を受け、長寿科学総合研究事業の一環として、平成22年度から「災害時高齢者医療の初期対応と救急搬送基準に関するガイドライン」を作成する研究班が立ち上がりました。本マニュアルの作成にあたり、平成23年度内の完成を目標に準備を進めてきました。

今回、東北地方太平洋沖地震が発生してから、被災された高齢者の方々に対する医療現場の厳しい現状が数多く報告されております。今回、本ガイドライン作成に当たった研究班および日本老年医学会は、ガイドライン「高齢者災害時医療ガイドライン」および本マニュアル「一般救護者用・災害時高齢者医療マニュアル」を現段階では試作版ではありますが、現在行われている被災地での高齢者災害時医療の一助にして頂ければ幸いです。

最後に、このマニュアルはあくまで一般的な診断・治療に向けての目安ですので、個々のケースにおいては医師にご相談下さい。

厚生労働省　長寿科学総合研究事業
「災害時高齢者医療の初期対応と救急搬送基準に関するガイドライン」研究班

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※
本マニュアルに掲載されている図表に関しまして、今回は緊急時試作版のため図表の著作権調査に不備がある場合があります。また、この試作版の商用目的での使用はご遠慮下さい。

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Ⅰ　避難所での高齢者の重要な疾患の特徴と予防法

1.　虚血性心疾患　(狭心症、心筋梗塞)・高血圧

『虚血性心疾患に気付くポイント』

痛みを感じる場所	前胸部～左胸部、左肩、首～下顎、心か部（みぞおち）など。胸痛が肩から腕などへ広がることもあります（放散痛）。
痛みの性質	締めつけられるような、圧迫されるような、重苦しいといった漠然とした痛み。胸やけ、肩凝り、歯痛、などが主な症状のこともあります。
痛みの持続時間	狭心症は数分～10 分くらい。心筋梗塞は数時間持続。

（注２）高齢者、特に糖尿病を持ち合わせいるケースでは、無痛性心筋虚血や、心筋梗塞になっても全く痛みがなく軽い息切れ程度の症状の場合（無痛性心筋梗塞）があるので注意が必要です。

『避難所における虚血性心疾患予防のポイント』

- もともと心臓病のお薬を服用していることを早くから周りの人や医療班に知らせておきましょう。周りの方も高齢者に聞きましょう。
- 普段の生活よりもストレスが増大するため、禁煙を徹底し、十分な水分を摂りましょう。また、塩分を控え、食物繊維（海草、キノコ、茎野菜）を多くとるよう心掛けましょう。
- 上記の症状があるならば、急いで医師・医療班に知らせましょう。

『高血圧』のお薬を服用していた高齢者に対する対応

- まず、もともと高血圧を指摘されていたかどうかを周りの人や医療班に知らせておきましょう。
- 普段の生活よりもストレスが増大するため、できれば血圧を連日測定できるよう周りの人と相談しましょう。（可能ならば朝と夜も）
- お薬手帳などが紛失してしまい、以前に飲んでいた降圧薬の内容が分からない場合は、まず医師に相談しましょう。
- 頭が痛い、胸がドキドキする、顔色の赤みが強い、などがあるようならば、急いで血圧を測ってもらい、医療班に相談しましょう。
- 禁煙、減塩、そして毎日 30 分程度は体を動かすよう心がけましょう。

2. 脳卒中

『脳卒中に気付くポイント』

以下のような徴候がある場合は脳卒中を疑い、緊急性が高いので医療スタッフにすぐに連絡してください。

- 突然の激しい頭痛。
- 回転性のめまい（しばしば吐き気、おう吐を伴う）。
- 意識障害（大いびきのような呼吸、意識もうろう、わけもなく暴れる）。
- 運動障害（顔面を含む半身の脱力や麻痺、口の片側からよだれが出る）。
- 呂律（ろれつ）が回らない。
- 言葉が出てこない、言いたいことがうまく言えない。
- 顔の片側と左右どちらか一方の感覚がおかしくなる。
- 急に視野が半分になる、ものが二重に見える。
- 急に以前には見られなかった行動をする。
- 座ったり、立ったり、歩いたりするのにバランスが取れない。

『避難所における脳卒中予防のポイント』

- 持病のお薬を服用していることを早くから周りの人や医療スタッフに知らせておきましょう（高血圧、糖尿病、脂質異常症、心臓病・特に慢性心房細動など）。
- 基本的には普段からの常用薬剤を継続しましょう。
- 手持ちのお薬を紛失した場合やお薬手帳など常用薬剤の情報が分からない場合は、まず医療スタッフに相談しましょう。中には最低限継続することが必要なお薬があります。
- 血を固まらせないお薬（抗血栓薬）は基本的に継続が必要ですが、医療スタッフに相談して下さい。（外傷などの被害の有無や、ストレス性潰瘍による消化管出血の有無などをチェックする必要があります。）
- 高血圧と大きく関係しますので、血圧をこまめにチェックしましょう。
- 普段の生活よりもストレスが増大するため、禁煙を徹底しましょう。
- 水分を十分摂取し、また塩分を控えましょう。保存食は薄味で調理しましょう（スープやソースの素は半分以下を目安に調理しましょう）。
- 食物繊維（海草、キノコ、茎野菜）を多くとるよう心掛けましょう。
- 散歩や体操などで毎日 30 分程度は体を動かすよう心がけましょう。
- 便秘に注意しましょう。
- 冬場は温度差に注意しましょう。

3. 感染症

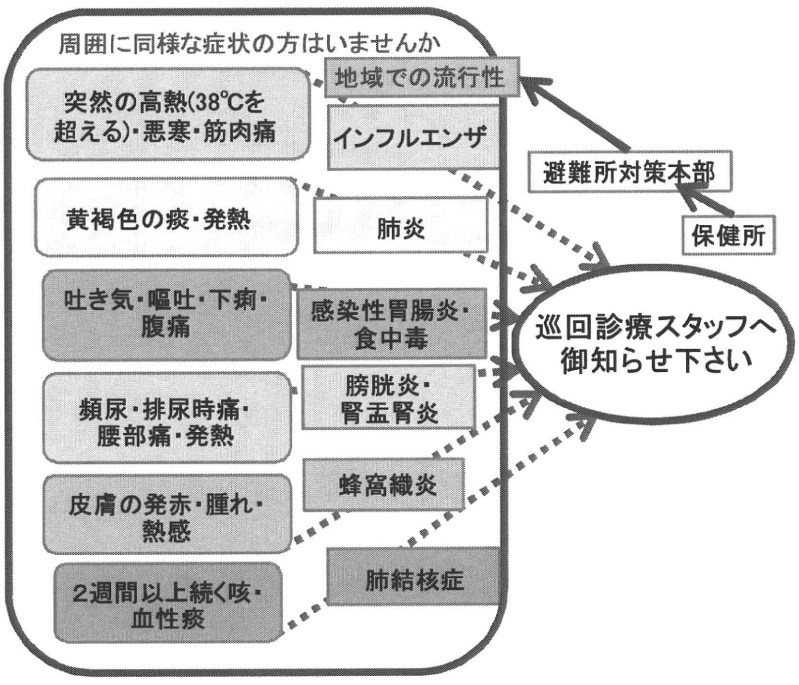
『感染症に気付くポイント』

災害が発生する前の時点も含めて被災地域における感染症の流行性が感染症に早く気付く上で有益な情報となります。特に、微生物の感染から病気の発症までの**潜伏期間が短い(即ち、時間～日の期間)感染症**には有効です。このような感染症にはインフルエンザ・食中毒・ウイルス性胃腸炎などが含まれます。周囲に同様な症状を持った方々がいないか注意し、感染症が疑われる場合は**巡回診療スタッフへ御知らせ**下さい。その点で、**避難所の対策本部を通じて所轄保健所等からの情報収集**が大切です。(図１参照)

事実、能登半島地震後の避難所において嘔吐・下痢を呈する多数の避難者がおりましたが、地震発生前より能登半島においてノロウイルス胃腸炎が流行しておりましたので、直ちに避難所でのノロウイルス胃腸炎の集団発生と推測することができました。

ただ、潜伏期間が長期に亘る(例えば、月～年の期間)感染症では、この流行性は病気に早く気付く上で必ずしも有益な情報になるとは言えません。そのような感染症として、肺結核症などがあります。

図１．感染症に気付くポイント



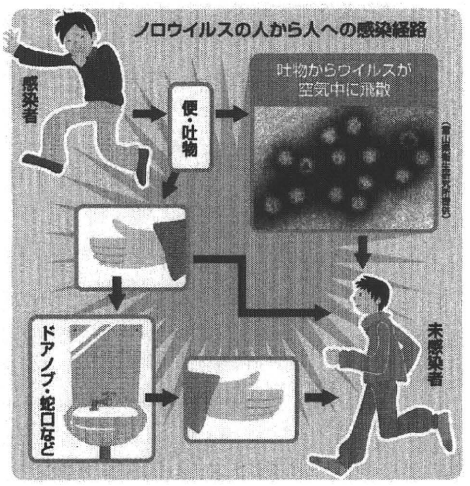
『避難所における感染予防のポイント』

- 避難所のような限られた空間に多数の避難者が生活していますので、感染症が集団発生しやすい環境となっています。
- 通常の感染予防は、**手洗いとうがい**の励行です。水の確保が困難な場合は、手指消毒薬を避難所内に設置あるいは各自に配布しますので利用して下さい。特に、トイレで排泄した後の手洗いあるいは手指消毒薬が重要です。
- **ヒト由来の液体(血液・尿・便・鼻汁・痰など)には感染力を持った微生物がおりますので、直接、手で触れてはいけません。避難所の床や仮設トイ**

レあるいは仮設水源が嘔吐物や下痢便で汚染しているのに気付きましたら、自分で処理せずに、**巡回診療スタッフへ知らせて**下さい。巡回診療スタッフが汚染環境を消毒(0.1%次亜塩素酸ナトリウムを用いて)します。

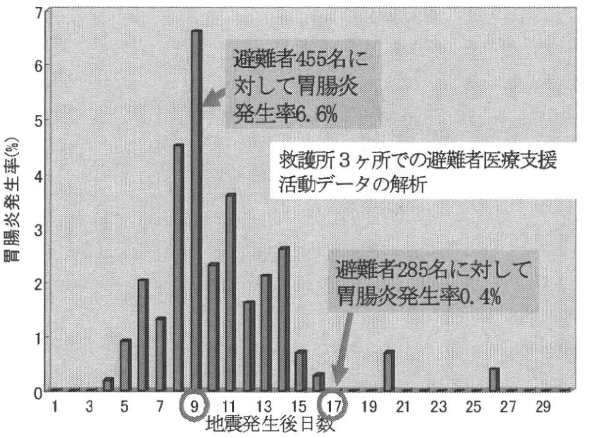
- ノロウイルスはヒト⇒ヒトへの感染が拡がって(図２参照)、胃腸炎が集団発生します。しかし、胃腸炎の方を**被災地の域外へ隔離する必要はありません**。前述の能登半島地震後の避難所にてノロウイルス胃腸炎が集団発生した際、手洗いあるいは手指消毒やうがいの励行・環境面への消毒によって介入後１週間で集団発生は終息へと向かいました(図３参照)。

図２．ノロウイルスのヒトからヒトへの感染経路



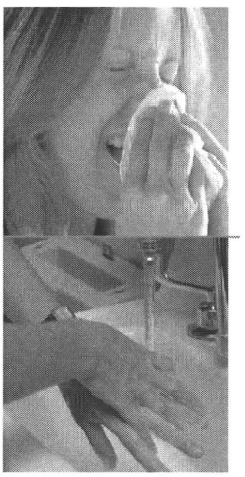
高橋孝,ノロウイルスこう防げ,月刊北國アクタス 211:36-39, 2007.

図３．能登半島地震発生後における胃腸炎発生率の推移



Nomura K, Murai H, Nakahashi T, Mashiba S, Watoh Y, Takahashi T, Morimoto S. Outbreak of norovirus gastroenteritis in elderly evacuees after the 2007 Noto Peninsula earthquake in Japan. *J Am Geriatr Soc* 56: 361-363, 2008.

図４．咳エチケット



また、呼吸器感染症を予防するために、**咳エチケット**があります。**咳・鼻水・くしゃみ・痰のような症状を持っている避難者**に対して、「咳やくしゃみが出る時に自分の口と鼻をティッシュペーパーで覆い(図４参照)、使用したティッシュペーパーは直ちに専用の廃棄容器(足踏み式の蓋付き容器・プラスチック製紙くずかご)へ捨てて、手が分泌物に触れるので手洗いや手指消毒を行う(図４参照)」ように促しましょう。症状が頻回の場合、マスク(巡回診療スタッフが配布)を着用してもらい、避難所では他の人と１m以上の距離を置いてもらうようにしましょう。

The Healthcare Infection Control Practices Advisory Committee. Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings 2007. http://www.cdc.gov./ncidod/dhqp/pdf/guidelines/Isolation2007.pdf

4. 脱水症

『脱水症に気付くポイント』

次のような徴候があるときは脱水を疑い、医療スタッフに連絡してください。

- ぐったりしている。
- 元気がない。
- 熱がある。
- 尿が少ない（濃い）。
- 脇の下が乾燥している。

『避難所における脱水症の予防のポイント』

以下の点に留意ください。

- 水分制限をすることは絶対に避けましょう。
- 特別な病気がなければ少なくとも一日１リッター程度の水分が必要です。
- 以下にあてはまる方は特に気をつけてください。

表１．高齢者における脱水のリスク

食事摂取が自立していない（介護が必要）
食欲が低下している（食事摂取量が低下）
嚥下障害がある
下痢または嘔吐がある
口渇を訴えるか口腔内乾燥がある
利尿剤を服用している
発熱がある
尿量が低下している
夏にエアコンがない（または使用しない）
トイレに行きたくないため水分制限をしている