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[Original Article]

START AND INITIAL RESULTS OF THE FUKUSHIMA PREFECTURE ACUTE MYOCARDIAL INFARCTION REGISTRATION SURVEY

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Abstract : Acute myocardial infarction (AMI) remains one of the most serious heart diseases and elucidation of its pathogenesis and advances in treatment strategies have been desired. In 2009, to understand the status of AMI in Fukushima Prefecture for improving treatment outcomes, a new AMI registration survey system was conducted throughout the prefecture. A total of 1,556 cases were registered in the initial 2 years from 2009 to 2010. The hospital-based overall incidence of AMI in Fukushima Prefecture was 37.9 people per population of 100,000 per year. Mortality from AMI within 30 days of onset was 10.2%. We report herein the actual situation of AMI onset and treatment in Fukushima Prefecture based on the initial results of the survey.

Key words : acute myocardial infarction, Fukushima Prefecture, registration survey

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INTRODUCTION

Acute myocardial infarction (AMI) remains a disease with high mortality despite current advances in medicine[1]. It is a disease in which early treatment is particularly important. In the Specified Report of Vital Statistics on Age-Adjusted Death Rates by Prefecture in Japan (2007) published by the Ministry of Health, Labour and Welfare, the age-adjusted mortality from AMI in Fukushima Prefecture is unfortunately among the highest in the entire nation, ranked at number 5 for both men and women[2]. Establishment of a treatment system for AMI and decreasing AMI-related mortality in Fukushima Prefecture are issues that need to be addressed. However, the data from the national government were prepared based on death certificates from each municipality, and there are no data based on accurate diagnosis of AMI that provide detailed information on the number of patients, incidence on a population basis, treatment methods, causes of death and risk factors. In 2009, with the aims of understanding the status of AMI in Fukushima Prefecture and improving treatment outcomes, a decision was made to conduct a registration survey of AMI at hospitals throughout Fukushima Prefecture with the First Department of Internal Medicine (currently the Department of Cardiology and Hematology), Fukushima Medical University, as the head office, and in cooperation with the Department of Health and Welfare, Fukushima Prefecture, the Fukushima Medical Association, and the Fukushima Hospital Association. A survey is being conducted with the cooperation of relevant hospitals, and an analysis of the data from the first 2 years of the study is described herein.

METHODS

Survey method and registration summary

In 2008, a preliminary questionnaire was conducted of 41 hospitals thought to be involved in treating AMI patients in Fukushima Prefecture. The survey was started on January 1, 2009 with 34 of these 41 hospitals that were able to treat AMI patients. Seven of 41 hospitals replied that they did not accept AMI patients at that time. Afterward, one additional hospital initiated a practice of AMI because a new cardiologist began working there, and participated in this registration from 2010. Finally, the survey was carried out with 35 facilities in Fukushima Prefecture (Fig. 1). For the present survey, a new method was adopted with the aim of improving the response rate. Initial information (date and time of myocardial infarction, sex, age) is sent by FAX soon after a patient is admitted (within 2 days) and is registered in the database at the head office. The name, date of birth, home address, and phone number are not registered for protecting patient's privacy. Therefore, the head office cannot identify an individual patient. Then, survey forms are sent once a month to the facilities, where clinical information is entered and the forms are returned. A total of 1,556 cases were registered over the 2 years from 2009 to 2010 (Table 1). In this survey, when a patient was transferred to another hospital in the acute phase, the entry was registered by the hospital where the patient was transferred. Although the method of AMI diagnosis and treatment was basically left to the discretion

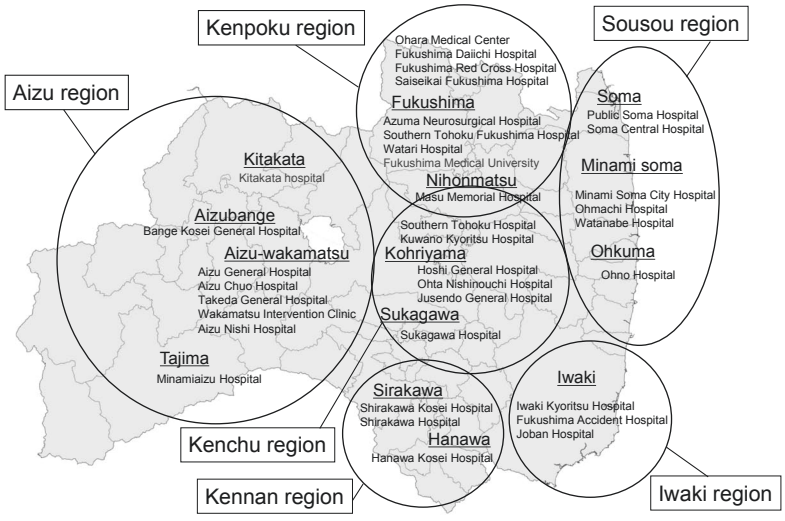

Fig. 1. Participating hospitals for cooperating with the survey and 6 regions in Fukushima Prefecture.

Table 1

Area	Population*	No. of patients (2 years)	Estimated incidence (/100,000/year)	Cardiac catheterization	Rate of cardiac cath.	Emergent cardiac cath.	Rate of emergent cath.	Reperfusion cases	No. of death	Mortality
Kenpoku	502,301	416	41.4 (35.8, 47.0)	387	93.0%	363	87.3%	365	50	12.0%
men	242,133	293	60.5 (50.7, 70.3)	278	94.9%	260	88.7%	265	32	10.9%
women	260,168	123	23.6 (17.7, 29.6)	109	88.6%	103	83.7%	100	18	14.6%
Kenchu	556,534	489	43.9 (38.4, 49.4)	480	98.2%	473	96.7%	471	43	8.8%
men	272,774	337	61.8 (52.5, 71.1)	336	99.7%	330	97.9%	331	19	5.6%
women	283,760	152	26.8 (20.8, 32.8)	144	94.7%	143	94.1%	140	24	15.8%
Kennan	151,566	117	38.6 (28.7, 48.5)	107	91.5%	102	87.2%	101	11	9.4%
men	74,928	83	55.4 (38.5, 72.2)	77	92.8%	73	88.0%	73	6	7.2%
women	76,638	34	22.2 (11.6, 32.7)	30	88.2%	29	85.3%	28	5	14.7%
Sousou	196,547	81	20.6 (14.3, 27.0)	67	82.7%	54	66.7%	61	10	12.3%
men	96,001	61	31.8 (20.5, 43.0)	54	88.5%	43	70.5%	49	6	9.8%
women	100,546	20	9.9 (3.8, 16.1)	13	65.0%	11	55.0%	12	4	20.0%
Aizu	299,471	259	43.2 (35.8, 50.7)	248	95.8%	233	90.0%	241	30	11.6%
men	142,644	181	63.4 (50.4, 76.5)	176	97.2%	163	90.1%	169	19	10.5%
women	156,827	78	24.9 (17.1, 32.7)	72	92.3%	70	89.7%	72	11	14.1%
Iwaki	347,676	194	27.9 (22.4, 33.5)	190	97.9%	187	96.4%	188	14	7.2%
men	168,620	156	46.3 (36.0, 56.5)	155	99.4%	152	97.4%	154	7	4.5%
women	156,827	38	10.6 (5.8, 15.4)	35	92.1%	35	92.1%	34	7	18.4%
Overall	2,054,095	1,556	37.9 (35.2, 40.5)	1,479	95.1%	1,412	90.7%	1,427	158	10.2%
men	997,100	1,111	55.7 (51.1, 60.3)	1,076	96.8%	1,021	91.9%	1,041	89	8.0%
women	1,056,995	445	21.1 (18.3, 23.8)	403	90.6%	391	87.9%	386	69	15.5%

*Population in January 2009. 95% confidence intervals are shown in parentheses.

of each hospital, cases needed to be registered within 78 hours after the onset of symptoms if the level of creatinine phosphokinase (CK) or its MB isoform (CK-MB) was increased more than twice the normal range.

Calculation of incidence rates of AMI in overall Fukushima Prefecture and each region.

Incidence rate (crude rate) of AMI per year was calculated as follows :

$$\text{Incidence rate} = \frac{\text{Number of registered AMI cases from 2009 to 2010}}{\text{Population on 2009}} \div 2$$

for prefecture overall or each region (Kenpoku, Kenchu, Kennan, Aizu, Sousou, or Iwaki). The values were expressed as per 100,000 people. 95% confidence interval (CI) was expressed as : 95% $CI = \pm 1.96 \times \sqrt{np(1-p)}$, where n was a population at risk and p was an incidence rate.

RESULTS

1) Occurrence of myocardial infarction

The estimated overall incidence of AMI per 100,000 person per year was 37.9 (95% confidence interval [CI], 35.2 to 40.5) (Table 1). Among all registered cases, 71% were men (mean age, 66.4±12.9 years) and 29% were women (mean age, 77.0±10.6 years) (Fig. 2). The estimated incidence of AMI in men was 55.7 (95% CI, 51.1 to 60.3) and that in women was 21.1 (95%, 18.3 to 23.8) (Table 1). Regional differences in the estimated incidence of AMI (e.g. 43.9% in Kenchu area and 20.6% in Sousou area) were seen (Table 1). Figure 3 shows occurrences of AMI by months and there were no large fluctuations throughout the year during the survey period.

2) Examination status

The time from occurrence of symptoms until hospital examination peaked at 1 to 3 hours ; more than 40% of patients were examined at a hospital or transferred to another hospital within 3 hours. On the other hand, the time until examination was ≥6 hours for 26.5% of patients (Fig. 4). Ambulances were used in approximately 70% of cases. In addition, the helicopter emergency medical services introduced in recent years were used in 2% of all cases (Fig. 5).

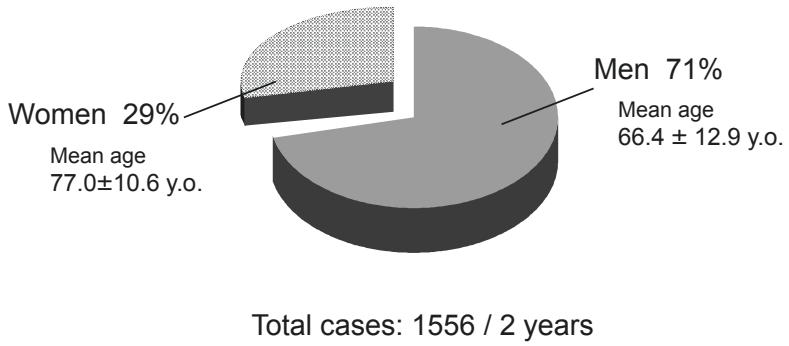

Fig. 2. Mean age and sex of the AMI patients.

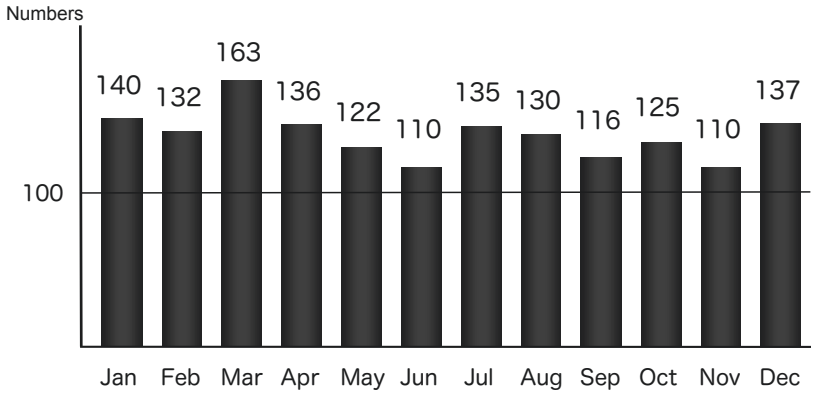

Fig. 3. Number of registered AMI patients by month.

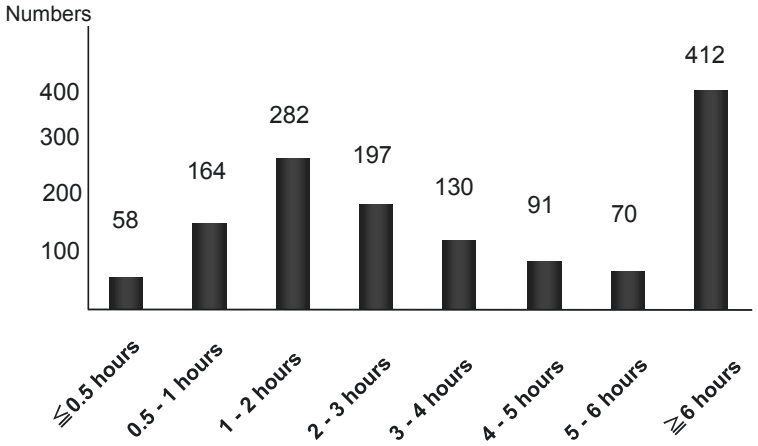

Fig. 4. Time from AMI onset until hospital examination.

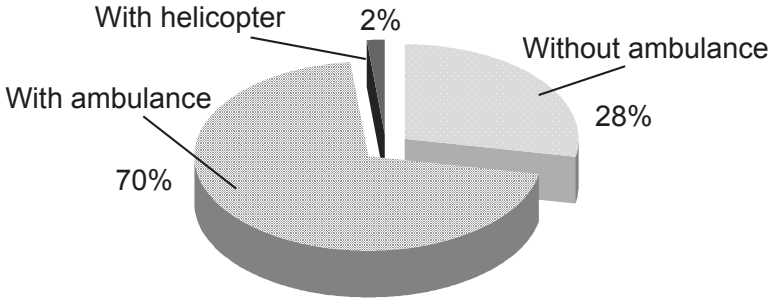

Fig. 5. Usage of emergency transfer systems.

Table 2. Onset symptoms.

Symptoms (overlap +)	Number	(%)
Chest pain/oppression	1,298	83%
Dyspnea	122	8%
Syncope	91	6%
Nausea	74	5%
Vomiting	83	6%
Epigastric pain	49	3%
With any symptom	1,543	99%

3) Onset symptoms

The most common symptoms at the time of onset were chest pain and tightness of the chest, which were experienced by 83% of patients. Gastrointestinal-like symptoms of nausea or vomiting were also seen in 11% of patients. Syncope was seen in 6% of all cases (Table 2).

4) Culprit lesion and reperfusion therapy

Cardiac catheterization was done in 95.1% of all cases, of which 90.7% were emergency procedures (Table 1). Successful reperfusion of the culprit lesion was achieved in 91.2% of cases. The culprit lesion was most frequently in the left anterior descending artery (LAD) in 44% of cases, followed by the right coronary artery (RCA) in 38% of cases, and left circumflex artery (LCX) in 14% of cases. The left main trunk (LMT) was also included in about 3% of cases (Table 3). Coronary artery bypass grafting (CABG) was performed in 11 cases (0.8%), and it was revealed that emergent catheterization had been the main treatment in AMI. Finally, stent placement was done in 86.8% of cases. Treatment was completed with thrombus aspiration only in a small number of cases (0.5%), but thrombus aspiration combined with a stent or balloon angioplasty (POBA) was done in 45.8% of all cases (Table 4).

5) Mortality

Mortality from AMI (within 30 days of onset) calculated from this survey was 10.2% for Fukushima Prefecture overall (Table 1). This survey registered cases definitively diagnosed as AMI at the participating hospitals, and thus did not include cases in which cardiopulmonary arrest occurred during transport or in which individuals

Table 3. Culprit lesions and its specific mortality.

Culprit lesion	Number of cases (%)	Number of death	Mortality (%)
LAD	658 (44%)	62	9.4%
RCA	558 (38%)	21	3.8%
LCX	221 (14%)	11	5.0%
LMT	46 (3%)	18	39.1%
HL	5 (1%)	0	0.0%

LAD : left anterior descending artery. RCA : right coronary artery. LCX : left circumflex artery. LMT : left main trunk. HL : high lateral branch.

Table 4. Reperfusion therapy.

Procedures	Number (%)
Thrombolysis alone	7 (0.5%)
Thrombolysis + POBA	3 (0.2%)
Thrombolysis + STENT	11 (0.8%)
POBA alone	50 (3.6%)
POBA + thrombus aspiration	45 (3.2%)
POBA + STENT	215 (15.1%)
STENT alone	412 (28.9%)
STENT + thrombus aspiration	310 (21.7%)
POBA + STENT + thrombus aspiration	261 (18.3%)
Thrombus aspiration alone	7 (0.5%)
CABG	11 (0.8%)
Others	89 (6.3%)

*STENT : 86.8%, *Thrombus aspiration : 45.8%

were discovered after death. Therefore, the figure 10.2% is considered to represent the mean in-hospital mortality. Culprit lesion-specific mortality was shown in Table 3. Although the numbers of patients with LMT lesion was small (n=46.3% of cases), its mortality rate was quite high at 39.1%, far above that for other lesions. As shown in Figure 6, the cause of death in the largest number of cases was heart failure (40.1%), followed by lethal arrhythmia (11.0%) and myocardial rupture including ventricular septal perforation (8.1%) ; these are in agreement with the conventional perception of the top three causes of death[1].

DISCUSSION

Establishment of a treatment system for AMI and decreasing AMI-related mortality are very important issues in Fukushima Prefecture. A questionnaire survey on AMI was previously conducted at hospitals belonging to the association of organizers of the Coronary Intervention Conference (CIC), a study group of physicians involved in coronary interventions in the prefecture that was started in 1999[3]. However, the response rate was only approximately 20% to 30%, as it appeared that all of the hospitals participating in that survey were busy with other aspects of patient care. Although the number of registered cases was only around 200 per year with the previous questionnaire survey, after the introduction of the new survey system, 786 cases were registered in 2009[4]. So it is likely that this new system is able to reduce the amount of missing data.

In this registration survey, the estimated incidence of AMI per 100,000 per year in men was 55.7 and that in women was 21.1 (Table 1). According to the Hisayama study[5], one of the most famous and important epidemiological studies in Japan, recent incidence rates (per 100,000 person-years) of AMI in men was 154 (95% CI, 92, 216) and that in women was 87 (95% CI, 47, 126). Those are quite different from our results. One of the possible reasons that made differences was that our registration survey counted AMI patients only who were treated in hospitals. This meant that our survey did not include

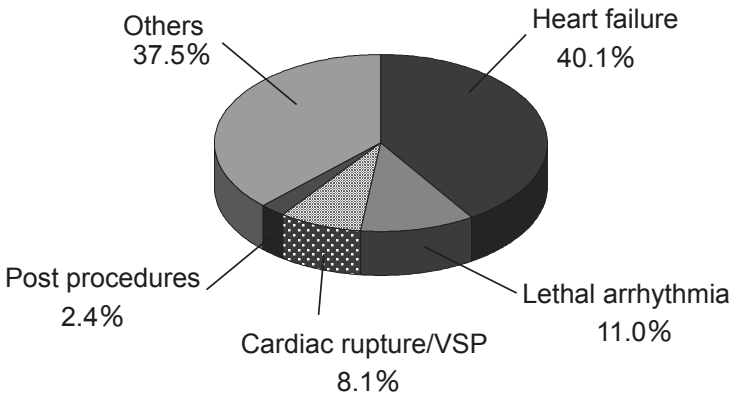

Fig. 6. Causes of death.

the patients who had been found in sudden death or died before being transported to the hospital. Therefore, the estimated incidence of AMI was lower in this survey than in the Hisayama study.

Well-known AMI symptoms of chest pain or oppression were experienced by 83% of all patients in this survey. On the other hand, gastrointestinal-like symptoms of nausea or vomiting were also seen in 11% of patients (Table 2), and so caution is needed for the differential diagnosis in the field of primary care. As shown in Figure 4, the time from occurrence of symptoms until hospital examination peaked at 1 to 3 hours. However, the time until examination was ≥6 hours for about one-quarter of patients, so education and enlightenment of general public as well as medical and paramedical staff on this matter is important to reduce the time from onset to hospital examination.

Fukushima Prefecture has the third largest area in Japan and has roughly 6 living- and medical-regions (Fig. 1). There is a difference in the number of hospitals and doctors (cardiovascular specialists) in each region. Regional differences in the estimated incidence of AMI may have been caused by the fact that when a patient was transferred to another hospital the entry was registered by the hospital where the patient was transferred and treated, as mentioned in Methods. This made it difficult to precisely ascertain the number of AMI patients by regions.

Limitations

This registration survey is based on hospital care, not a population-based cohort study such as the Framingham heart study[6] in the US or the Hisayama study[5] in Japan. Patients with AMI in this report included only those who were treated in hospitals, so did not include those who had been found in sudden death or died before admitting to the hospital. There were also cases in which an event occurred within Fukushima Prefecture and the patient was taken to a hospital outside of the prefecture, or conversely, when an event occurred outside of the prefecture and the patient was taken to a hospital inside the prefecture.

CONCLUSION

Here, we reported the results from the first 2 years (2009-2010) of the new AMI case registration survey in Fukushima Prefecture. In 2011, one more hospital (Northern Fukushima Medical Center) joined and has been participating in this survey. By continuously collecting data, we hope to obtain accurate and specific information for the prefecture that could not be ascertained from the statistics of the national government, which were based only on death certificates. A future issue will be how to use the accumulating data on AMI in a way that will be beneficial in actual clinical practice, including the establishment of systems for early diagnosis and treatment, and better transport to lower the mortality rate.

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