

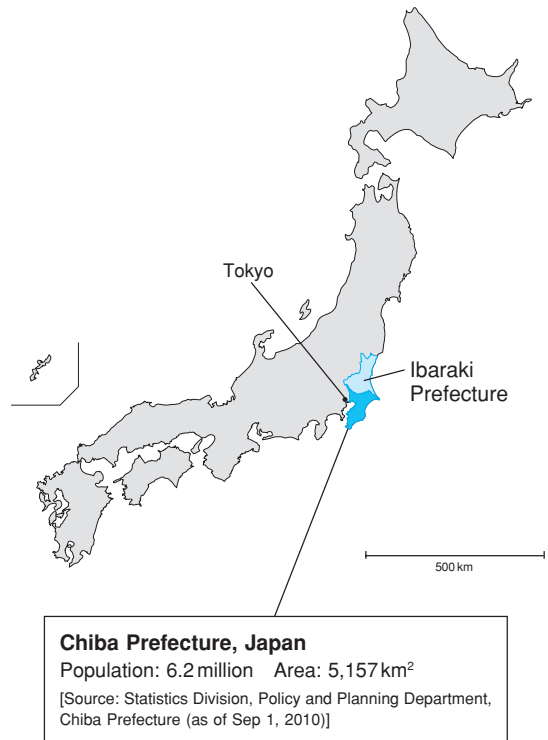
Inba Clinical Pathway for Local Stroke Network with Helicopter Emergency Medical Service in Chiba, Japan

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Masahiro MISHINA,*¹ Hisashi MATSUMOTO*²

Abstract

Many parties and various professions are involved in stroke care, including citizens making prompt calls for ambulance, ambulance crews who transport patients appropriately, consolidation of patients and medical resources with a focus on stroke units, rehabilitation hospitals for reduction of patients' sequelae, primary care physicians who are in charge of managing risk factors to prevent the recurrence of disease, and long-term care services and care managers that support in-home care of patients. In Chiba Prefecture, the helicopter emergency medical service (HEMS, so-called "doctor helicopter" in Japan) was launched in October 2001, with Nippon Medical School Chiba Hokusoh Hospital serving as the base hospital. Currently, the number of dispatches is ranked the highest in Japan. In March 2008, the Inba Clinical Pathway for local Stroke network (InCliPS) was launched to build a network of medical resources beyond the boundaries of healthcare zones to utilize limited rehabilitation resources better. Then in February 2009, the liaison critical pathway for stroke designed for common use throughout Chiba Prefecture was established. Although these attempts are tools that merely link the sites of stroke onset to medical facilities of acute care, rehabilitation, and convalescent phases, we hope they help to halt healthcare collapse in Chiba by promoting the efficiency of medical services and prepare clinical practice system for the next generation.



Key words Doctor helicopter (doctor-heli), Liaison critical pathway for stroke, Database, Healthcare collapse, Helicopter emergency medical service (HEMS)

Introduction

Healthcare deterioration in Chiba Prefecture, Japan, has become an imminent issue. The urgency of the situation is symbolized by the complete suspension of operation of Choshi General Hospital, a public general hospital with 393 beds in

Choshi City from September 2008 through May 2010. Although the hospital has resumed operation now, it is still limited to internal medicine for outpatients only. The crisis is also true in the field of stroke care. A questionnaire survey conducted by the Chiba Prefectural branch of Japan Stroke Association in 2008 (<http://www.nms.ac.jp/ni/JSA/>

*1 Senior Assistant Professor, The Second Department of Internal Medicine, Nippon Medical School, Tokyo, Japan (mishina@nms.ac.jp).

*2 Associate Professor, Shock and Trauma Center, Nippon Medical School Chiba Hokusoh Hospital, Chiba, Japan.

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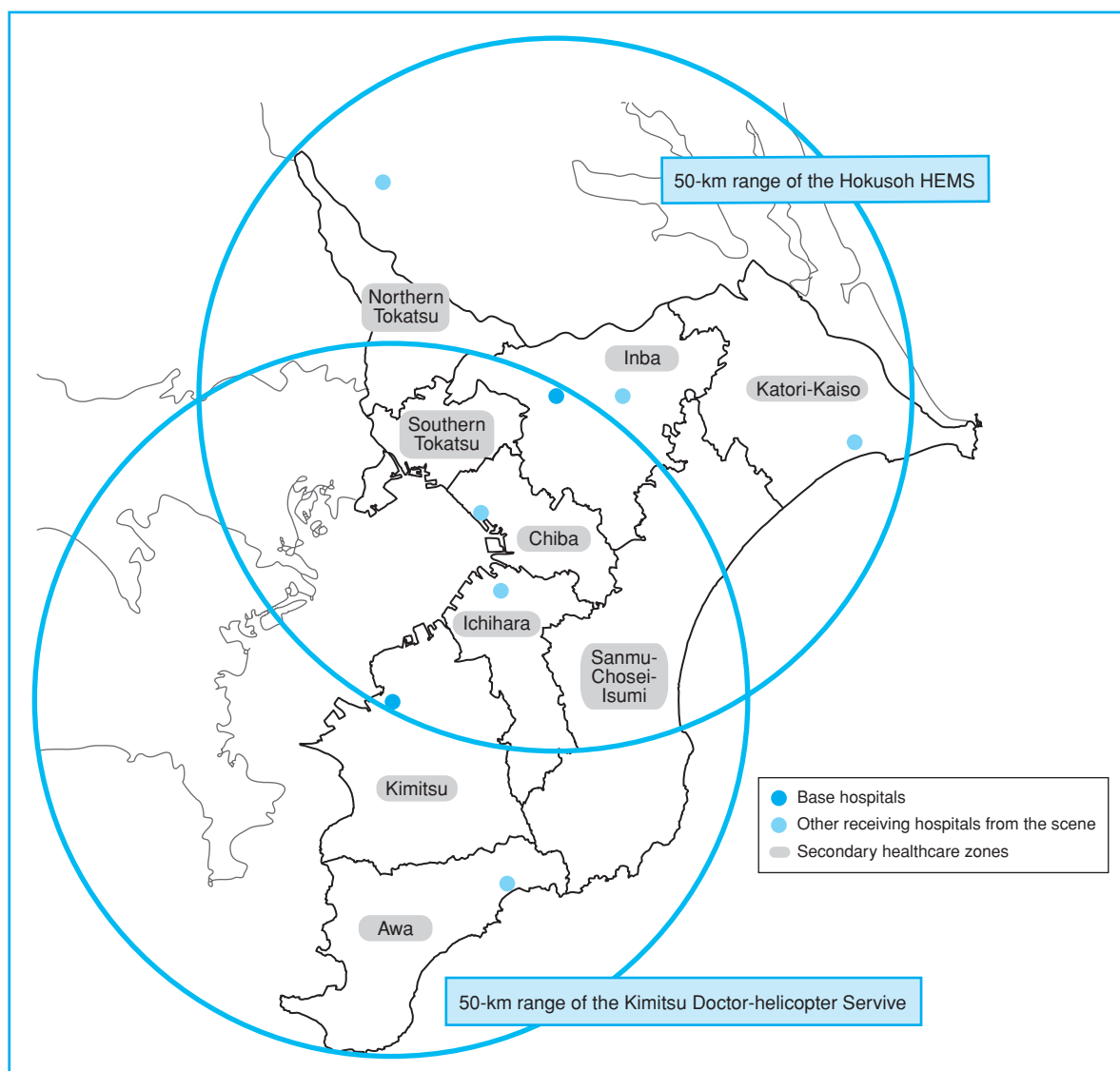


Fig. 1 Secondary healthcare zones and 2 helicopter emergency medical service (HEMS) systems in Chiba Prefecture, Japan

reports.html; accessed in Oct 2010, in Japanese only) revealed the current situation in this prefecture that thrombolytic therapy with intravenous plasminogen activator (alteplase) had not been sufficiently utilized.

One reason for the insufficient penetration of thrombolytic therapy is the delay in calling for ambulance resulting from a poor understanding of acute stroke among the general public. However, the healthcare system itself is also fraught with some issues. Many stroke care facilities incorporated in Chiba Prefecture healthcare

plan are suffering from the shortage of staff neurosurgeons or neurologists and are unable to always administer the thrombolytic agents.

On the other hand, 4 of the 9 healthcare zones in Chiba Prefecture had only 1 facility each where thrombolytic therapy was available; however, the number of implementations was higher in those zones than in the other better-equipped zones. This suggests that having 1 single stroke care unit (SCU) with a high level of clinical practice in a zone, rather than several facilities with staff shortage, can be sufficient to steadily per-

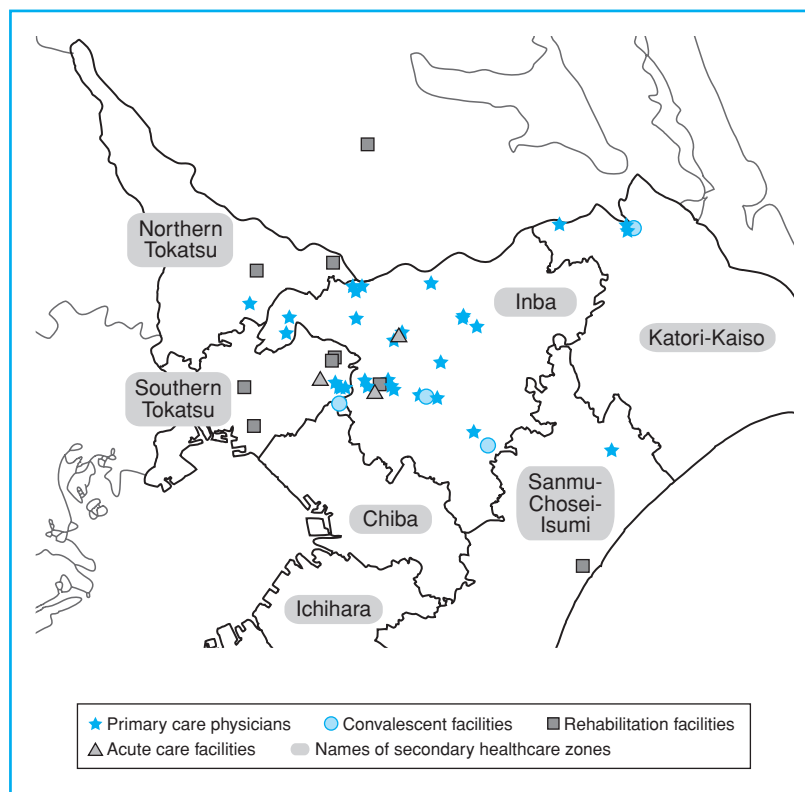


Fig. 2 Distribution of facilities participating in Inba Clinical Pathway for local Stroke network (InClIPS)

As of April 30, 2009, participating facilities comprise 3 acute care hospitals, 9 convalescent facilities, 4 rehabilitation facilities, and 30 clinics of primary care physicians. Since there are no rehabilitation facilities in the Inba healthcare zone (though a rehabilitation ward was built in a hospital in September 2009), healthcare networking with rehabilitation facilities in surrounding areas is in operation. The transport range of the helicopter emergency medical service (HEMS) includes the southern part of Ibaraki Prefecture, and therefore, cooperation with facilities outside Chiba Prefecture has been realized.

form thrombolytic therapy.

According to the questionnaire survey mentioned above, thrombolytic therapy in Chiba Prefecture was more frequently performed in departments of neurosurgery than in departments of neurology and internal medicine. Therefore, we speculate that this problem in the stroke care system may not remain in providing thrombolytic therapy but affect the performance of emergent neurosurgery for subarachnoid hemorrhage or head trauma.

Helicopter Emergency Medical Service (HEMS) in Chiba Prefecture

An important issue in integrated acute stroke care system is patient transport time. Although traffic congestion is infrequent in Chiba unlike in Tokyo, patients may need to be transported for

a long distance in some cases. In such cases, the Helicopter Emergency Medical Service (HEMS, commonly known as “doctor helicopters” or “doctor-heli” in Japan), ambulance helicopters equipped with emergency medical devices and staffed with an emergency physician and a flight nurse that can be dispatched to the site of emergency, demonstrate its power.

In Chiba Prefecture, the first HEMS was launched in October 2001, with Nippon Medical School Chiba Hokusoh Hospital serving as the base hospital. This system, called Hokusoh HEMS, was dispatched on 687 missions in Fiscal Year (FY) 2007, which was the most frequent in Japan. In addition to the Hokusoh HEMS, Kimitsu Chuo Hospital began to serve as the base hospital for the second HEMS system in Chiba Prefecture. This made the entire Chiba Prefecture and the southern part of Ibaraki

Table 1 Criteria for applying Inba Clinical Pathway for Local Stroke Network (InCliPS)**Criteria for discharge to home**

- At discharge, the patient has no symptoms at all, or has no significant disability despite symptoms and is able to carry out all usual duties and activities.
- At discharge, the patient has slight disability and is unable to carry out all previous activities, but is able to look after his/her own affairs without assistance and able to attend rehabilitation programs in an outpatient clinic.
- The patient is hardly able to attend outpatient rehabilitation programs due to dementia, delirium, or poor general condition, but in-home care is being prepared already.
- The patient had severe disability before stroke onset, and in-home care is already in place.
- The patient or his/her family does not wish to continue in-hospital rehabilitation programs.

Criteria for transfer to a convalescent care hospital

- At discharge, the patient requires some help but has no complications or sequelae that interfere with implementation of outpatient rehabilitation programs.
- At discharge, the patient has slight disability but is able to look after his/her own affairs without assistance, whom in-hospital rehabilitation programs is desirable.

Prefecture within a range of 50 km from either base hospital within 15 minutes of transport time when using the helicopter (**Fig. 1**).

Although the HEMS is most frequently dispatched for traumatic cases due to traffic accidents, stroke cases are also common. According to our survey,¹ many patients transported by the Hokusoh HEMS were in severe conditions such as cerebral hemorrhage, subarachnoid hemorrhage, and cardiogenic cerebral embolism. The acute stroke treatment guideline in the USA clearly states the effectiveness of patient transport by helicopter in providing thrombolytic therapy in a timely manner.² However, our survey¹ and the aforementioned questionnaire survey in Chiba Prefecture revealed that there were still few patients transported by the Hokusoh HEMS who were treated with thrombolytic therapy. Although the main reason was the uncertainty of the time of stroke onset and delay in requesting emergency service, another factor in many cases was serious conditions of patients that we judged not suitable for thrombolytic therapy.¹

The operation and maintenance of the HEMS require a large cost, approximately 200 million yen per year. But the cost-effectiveness of the helicopter transport for patients who received thrombolytic therapy has already been reported.³ Now that the HEMS uses two helicopters in Chiba Prefecture, we can expect cases of moderate stroke to take advantage of the service, providing

thrombolytic therapy more effectively. At the same time, acute care hospitals obviously must be prepared sufficiently to receive such patients.

Inba Clinical Pathway for Local Stroke Network (InCliPS)

Rehabilitation is the essential element of the current stroke treatment. In Chiba Prefecture, rehabilitation hospitals are mostly located in the north-west portion of the prefecture (southern and northern parts of Tokatsu). Many other areas had no rehabilitation hospitals until 2008, including the Inba Zone where Nippon Medical School Chiba Hokusoh Hospital is located.

In July 2007, Shinyachiyo Hospital and Nippon Medical School Chiba Hokusoh Hospital began to discuss a liaison clinical pathway for stroke while referring to preceding examples.⁴ Together in March 2008, we launched Inba Clinical Pathway for local Stroke network (InCliPS) (**Fig. 2**). The web site (<http://www.nms.ac.jp/ni/inclips/>; accessed Oct 2010, in Japanese only) provides information on the participating facilities, history, PDF files of clinical path sheets, and operation reports. With cooperation from rehabilitation and convalescent facilities, in-home rehabilitation service was also provided in InCliPS. To evaluate data obtained from primary care physicians, the modified Rankin Scale (mRS),⁵ most commonly used as a severity scale

of stroke, and Mini International Neuropsychiatric Interview (MINI),⁶ an easy diagnostic scale for depression, were adapted to cover mental aspects including post-stroke depression as well as motor function.

Although patients with mild stroke are usually restored to a certain level in about 1 month after onset, those with severe stroke may exhibit gradual improvement for as long as 6 months after onset.⁷ In InCliPS, under the policy of not depriving severe stroke patients of opportunities to undergo rehabilitation programs, severe cases corresponding to mRS 5 are also included in criteria for transfer to rehabilitation facilities (Table 1).

However, these criteria allow severe patients who are difficult to be discharged home without plenty of rehabilitations to be admitted to rehabilitation facilities, while interfering with the admission of mild patients who can return to society with relatively short but aggressive rehabilitation programs. According to the FY 2008 operation result survey of InCliPS, severe diseases such as cerebral hemorrhage and cardiogenic cerebral embolism occupied the majority of cases that the pathway handled (37.4% and 24.5%, respectively), and lacunar infarction, which is commonly mild, was infrequent (7.2%). Patients with mRS score of 5 accounted for 29.3%. The interim report for the first half of FY 2008 had already noted that transfer of patients with severe conditions concentrated at the most specialized rehabilitation hospital among the InCliPS facilities. This is because days of hospitalization can be shorter at more specialized rehabilitation facilities, allowing early transfer. However, such imbalance lowers the overall efficiency of the system for the region.

Based on the findings from the interim report, we took measures to remedy this issue, such as encouraging acute care facilities to disperse the introducing hospital when transferring severe patients. We also asked a rehabilitation and convalescent hospital particularly dealing with

severe patients to participate in InCliPS. Consequently, InCliPS proved very useful not only for distributing medical information among participating facilities but also for improving the stroke care system in the community as a whole.

Various parties and professions are involved in completing the descriptions of clinical path sheets. Using database software FileMaker Pro, we developed a data-entry system for InCliPS that allows inputs from each involved department, including the clinical data on post-rehabilitation phase. This database proved useful in conducting a community survey for stroke care for the entire community.

Conclusion

In order to provide solid acute stroke care, prompt emergency calls from citizens, prehospital emergency services including the HEMS, aggregation of patients and medical resources on SCUs, and collaboration among rehabilitation hospitals, primary care physicians, and long-term care centers are necessary. In addition, we need a flexible medical system for stroke that can adapt to next generation therapies such as clot retrieval devices. To this end, a liaison clinical pathway for stroke is a very effective mean.

Previously in Chiba Prefecture, various types of clinical pathways for stroke were operating among communities. But they were inefficient, requiring rehabilitation facilities to use several different formats. In Chiba Prefecture, therefore, a common liaison clinical pathway for the entire prefecture was developed. In order to share medical information over the Internet among participating facilities, creating an online network is also under consideration. However, these are just tools of transmission and compilation of medical information. Sufficiency and reinforcement of facilities involved in acute care, rehabilitation, and convalescent phases are most needed in Chiba Prefecture.

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