

PHYSICAL TRAINING PROGRAM

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INTRODUCTION

Recent interest has been centered on the physical training program for myocardial infarction. In 1956, N. Kimura, based on his clinical experiences, emphasized that suitable amount of physical training should start at a timely stage as early as possible in the phase of convalescence from the acute attack in order to promote the social return, and initiated an unique training program for the patient with ischemic heart disease.

In this program the Master's two step was introduced, instead of using it as a diagnostic tool, not only for estimation of a suitable amount of exercise but also for interval training on such exercise. In practice a suitable amount of exercise is specified for each individual at a given stage irrespective of existence of abnormalities in ST segment at rest.

The program follows trial and error method or adjusting number of trips over the two step in 90 seconds according to the criteria which will be described later. In this way the program can be advanced stepwise with gradual improvement of patients in the physical capacity. From 1955 to 1969 this program has been applied to 94 patients with myocardial infarction except those with subsequent serious complications. These experiences have proved that this training can be performed quite safely and reasonably without any expensive equipments requiring the standard techniques.

The purpose of this paper is to report the details of clinical practice and the retrospective analysis of the cases.

SUBJECTS

The subjects of this study were 125 cases with myocardial infarction which were admitted to our department from 1955 to 1969. They consisted of 113 male and 12 female, and their mean age was 58.3. Out of them 14 cases died in the hospital course and 17 cases were placed on digitalis, so that 94 cases had completed our rehabilitation program.

METHOD

In cases with no serious complications following myocardial infarction, the elevated ST segment returns close to the base line accompanied by the development of coronary T usually within a few weeks and erythrocyte sedimentation rate becomes within 30 mm per an hour.

At this time the patients is allowed to stand up on the floor and to walk slowly around his bed. Whenever a trial of the increased physical activity is prescribed for the patient, it is of principle to confirm whether that activity is of overload, according to the post-exertion ECG response. Such easy training is gradually increased in frequency and duration for the following several days. In case that neither unusual symptoms nor electro-cardiographic abnormalities are observed in this course, the patient is considered to be ready for more active physical training. Based on our clinical experiences, one fourth of the standard Master single trips in 90 seconds are usually not so of overload for most of the patients at this stage. For example, for a 52 year old male weighing 60 Kg, the Master's table stipulates 22 trips in 90 sec. So one fourth of 22, approximately 5 or 6 trips in 90 sec. might be the first trial. In such a case, however, steps are to be travelled slowly one at a time so that at one

point both feet are on each step to keep exercise speed as constant as possible.

We usually utilize a metronome for this purpose. Whenever the patient is aware of any unusual sensations, he must discontinue exercise immediately. It is necessary to make a check if the unusual sensation were due to physiological or psychological disorder. ECG is recorded in the same way as on the Master's test. The appropriateness of exercise amount is judged according to post-exertion changes of ECG, (1) the significant deviation of ST segment from the resting level, (2) multiple premature contractions, and (3) an increase in the negativity of the ischemic T wave are regarded as positive signs for the overload. What we regard as no significant deviation of ST segment from the resting level is the same as being "equivocal" in the usual sense.

Besides, it is practically important to notice that in the exercising coronary patients ECG reveals gradual changes of T waves at first in general and ST deviation following them later.

Therefore, changes of T waves may be available as the prodromal signs for the beginning of ST deviation. If neither significant deviation of ST segment nor significant change of T wave is observed, the work load can be strengthened a little. When the coronary T becomes less prominent or biphasic with the equivocal deviation of ST segment, a given exercise may be moderate. If the initial exercise i.e. 5 trips in 90 sec. is over, the previous training should be resumed for another week. Whenever the moderate exercise is determined likewise, the same exercise is given for interval training once in the morning and another in the afternoon for the following few days. The frequency of such interval training is increased according to the program.

ECG examination on interval training is not necessary, provided a given exercise is performed in the same condition. The training should be carried out at intervals of more than an hour, and avoided within at least an hour after meals. On the 7th training day one-third or one half of the Master's single trips i.e. 7 or 11 trips in 90 sec. is a trial to determine a next moderate exercise. If a next moderate exercise is found, the training program is advanced likewise. It should be mentioned here that exercise speed becomes constant when a suitable amount of exercise increases more than the Master's single trips. In this way a suitable amount of exercise can be increased finally up to the Master's single or double trips in most of the patients within a few months.

The final goal of the training program is as a rule to pass the Master's double trips. When a suitable amount of exercise of the patients becomes equal to or more than the Master's double trips, they are completely free from the limitation of the physical activity in their usual social life. Even when the final suitable amount of exercise remains less than the Master's single and half trips but more than single trips, the patients can well tolerate their usual social works, though some of them must always keep their own slow pace.

Similarly we can prescribe reasonably the allowable daily activity to each patient at any recovery stage from his number of trips equivalent to a suitable amount of exercise. Finally there remain a few problems such as the management of the patients with frank heart failure who are placed on digitalis and the patients with intractable angina pectoris. In general most of such patients are not suitable for the physical training but may be subjected to the surgical treatment if indicated. We have encountered no serious accidents in this serial study for the past 16 years.

ANALYSIS OF THE RESULTS

In consideration of 94 cases which underwent our rehabilitation program, several factors relating to the improvement of the physical capacity were analyzed retrospectively. They were divided into the following 3 groups according to their respective physical capacity at the end of the program; group I of 36 cases whose achievement matched the Master's double trips or more. Group II of 41 cases whose achievement was intermediate between Master's double trips and single trips, and Group III of 17 cases who failed the single trips test.

In each group the data were investigated as to the age, the duration of the days from the first attack to the admission, the number of the Q wave in the standard 12 leads, the concomitant presence of the ST-T abnormalities excluding the coronary T, such as strain pattern or flat T, and the cardio thoracic ratio on admission. The mean age was 52.08 ± 8.92 in group I, 60.80 ± 8.74 in group II and 62.82 ± 8.21 in group III; these were the significant differences between group I and group II, III. ($P < 0.005$).

The mean duration of the days from the first attack to the admission were 86 days in group I, 270 days in group II and 323 days in group III; there was the significant difference between group I and II ($P < 0.025$).

The prevalence of the ST-T abnormalities excluding the coronary T was significantly high in Group III ($P < 0.005$). The cardiopulmonary ratio on admission was 48.79 ± 6.01 in group I, 52.33 ± 5.86 in group II and 55.69 ± 6.76 in group III; there was the significant difference between group I and group II, III, respectively ($P < 0.025$, $P < 0.005$).

On the other hand, no significant differences were observed between the number of the Q waves in the 12 standard leads in the 3 groups. Accordingly, the final improvement of the physical capacity might be expected to some extent from the following: (1) the age, (2) the concomitant ST-T abnormalities excluding the coronary T (3) the cardiopulmonary ratio on admission and (4) the duration of the days from the first attack to the admission.

Especially it is noteworthy that the mean duration of the days from the first attack to the admission of group I was 86 days or 3 months, whereas that of group II and III was more than 9 months.

SUMMARY

1. The clinical practice and the merits of the unique physical training program which was initiated by N. Kimura for the patients with myocardial infarction was described in detail.

2. Ninety-four patients with myocardial infarction except those with subsequent serious complications and/or digitalis administration had undergone our physical training program and the results were investigated retrospectively. As the important determinants of the improvement of the physical capacity the followings should be taken into consideration, such as the age, the presence of the concomitant ST-T abnormalities excluding the coronary T, an increase of the cardio-thoracic ratio on admission and the duration of the days from the first attack to commencement of this rehabilitation program.

On the other hand, the number of the Q waves in 12 standard leads demonstrated no significant differences.