SURVEY OF TELETHERAPY IN JAPAN

Part V. State of fractionations in one week

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日本における放射線治療の現状について

第5報 週間分割回数について

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昭和49年末より50年にかけて行なつた，我国における放射線治療の調査から，現在どのような分割方法が行われているかを計算した．調査は総数の約90%以上の回収があると考えられ，我国の現状を充分反映している．

これによると約7200人の患者が治療を受けて居り，33%が週6回，48%が週5回，それ以外が19%で平均分割回数は週4.94回である．又この調査によれば我国では約 430の病院で約 550の装置が使われているので，1病院当り平均17.4人が週延86.2回，1装置当り13.6人が67.4回治療を受けていることになる．

週6回治療の割合は病院全体のベット数にはあまり関係しないが，放射線科のベット数，診療放射線技師数，放射線治療の患者数，装置の価格，特に放射線科医の数が多い程，即ち放射線科の規模が大きい程，減少していることがわかつた．

週間分割回数がこのように病院によつて異なるので，rad 表示による比較は充分慎重に行なう必要があろう．

尚，これら病院のうち放射線科医が常勤する施設は60%であり，放射線科病床が10床以上の施設は僅か25%であつた．これを含めて日本の放射線治療を充分検討する必要を示す一つの資料になると思う．

From the survey of hospitals which have teletherapy unit(s), present state of fractionations used in one week was examined from various factors. The original list for the survey was complied from the list of hospitals made by 6 commercial companies, which manufacture or import almost all of the apparatus used in Japan, and the Japan Radioisotope Association which has a monopoly in the import and discarding of radioisotopes legally[1]. The initial survey was made by sending questionnairs to the chief

Table 1. Number of hospitals surveyed

Both lists from companies* & JRIA+	358	
Additional list from companies	99	
Additional list from JRIA	71	
Total	528	
omitted because of mislisting		11
Surveyed	517	
no answer		63 (12.2%)
Answered hospitals	454	
not used°		32 (7.1%)
Number of hospitals analyzed	422	

*Toshiba Medical, Shimadzu Seisakusho, Hitachi Medico, Nippon Denki, Chiyoda Nichiei, Nippon Siemens.

+Japan Radioisotope Association.

°Discarded 18, Preparing 8, Closed 5, Other purpose 1.

Table 2. Recovery rate of survey according to apparatus

Apparatus	Surveyed	Used	Preparing	Discarded	No answer	Non-medical
Stationary cobalt	275	157 (57)	0 (0)	70 (25)	48 (17)	—
Rotational cobalt	295	251 (85)	6 (2)	19 (6)	18 (6)	1 (0)
Betatron (<20 MeV)	17	16 (94)	0 (0)	0 (0)	1 (6)	—
〃 (≧20 MeV)	31	29 (94)	2 (6)	0 (0)	0 (0)	—
Lin.Acc. (<10 MeV)	50	45 (90)	2 (4)	0 (0)	3 (6)	—
〃 (≧10 MeV)	48	39 (81)	7 (15)	0 (0)	1 (2)	1 (2)
Total	716	537 (75)	17 (2)	89 (12)	71 (10)	2 (0)
Hospital	517	422 (82)	8 (2)	23 (4)	63 (12)	1 (0)

Numerals in parentheses are percentage in each line (apparatus).

technicians of these hospitals and then to the radiologists in the hospitals employing them, found from answers from the chief technicians. The survey was started in October 1974 and closed in May 1975 after several requests for the answer including those to directors of these hospitals for supporting this survey.

The number of these hospitals is listed in Table 1. Total number of these hospitals reached 517 at the end of 1974 and, 454 hospitals (87.8%) among them answered by the chief technicians. In these 454 hospitals, 32 hospitals (7.1%) were not giving radiotherapy at that time and reasons for it are listed in Tables 1 and 2. Among the remaining 422 hospitals, 42 hospitals were carrying out the therapy without any consultation with radiologists and 116 hospitals, by part-time radiologists. Consequently, further survey of the radiologists was made in the remaining 264 hospitals. The recovery rate of the questionnairs is given in Fig. 1, and listed in Table 2 rearranged by the type of apparatus in these hospitals which suggests that true recovery rate concerning teletherapy should be more than 90% because hospitals with only the stationary telecobalt apparatus decreases the mean, and about 70% of no answer hospitals, those not using radiotherapy, are included in this group. The recovery rate excluding the hospitals with stationary telecobalt is about 95%. Some doubtful answers from chief technicians were corrected

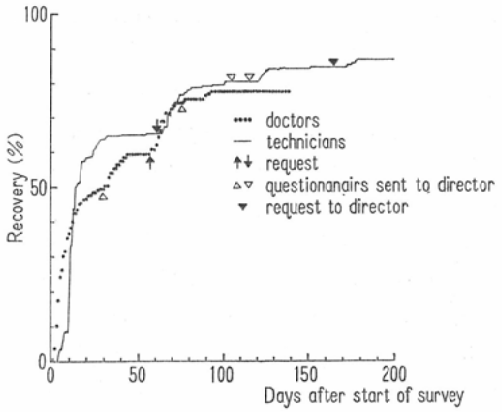


Fig. 1. Recovery rate of questionnairs.

by answers from radiologists. This survey is considered to demonstrate the present status of radiotherapy in Japan. According to this survey, about 430 hospitals had capacities for teletherapy at the end of 1974 and about 550 apparatuses were being used.

Several analyses have already been reported elsewhere for periodical changes, manpower, and geographical distribution of radiotherapy facilities[1-4]. This paper describes analysis on the number of fractions used per week, because the past Japanese custom was generally six working days per week instead of five in European countries and U.S.A., and this results in different efficiency for the same dose (rads) of radiation[5]. According to the present results, about 7200 patients were being treated at the end of 1974 and among them 33% were treated by 6 fractions per week, 48% by 5 fractions, 3% by 4 fractions, 12% by 3 fractions, 3% by 2 fractions, and 1% by one fraction, as demonstrated in the top of Fig. 2.

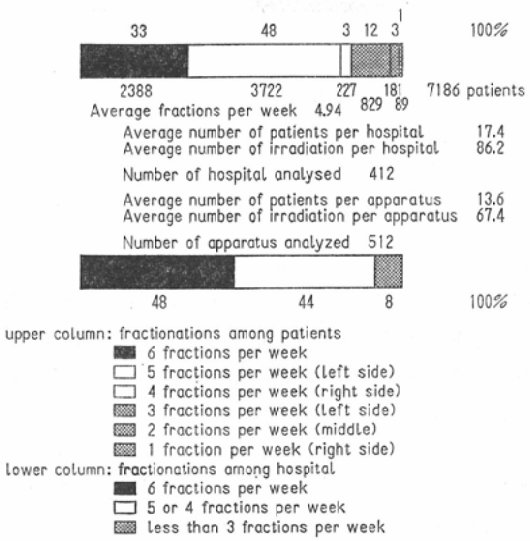


Fig. 2. Number of patients treated and fractions per week (2% was excluded because of inadequate answer to questionairs).

The average fraction is 4.95 per week. This means that 5 fractions per week is being utilized in Japan as in other parts of the world.

Average number of patients treated was 17.4 patients per hospital and 13.6 patients per apparatus, and the average number of irradiation per week was 86.2 times per hospital and 67.4 times per apparatus. Apparently incorrect answers, inadequate entry, and blank cards were excluded from the analyses, and these are noted in each of the graphs.

In most of the hospitals, the number of fractions per week is fixed for all the patients but in some hospitals several kinds of fractionations were used. To simplify the analyses, the number of fractions was divided into three group of 6 fractions, 5 or 4 fractions, and less than 3 fractions per week and all the hospitals were divided into these three groups. If the fractionation of the hospital were fixed, the hospital was placed in this fraction number group. If the number of fractions were not fixed, the fractionation group was selected from the number of fractionations by which the largest number of patients were treated and, if the number of treated patients were equal in two or three groups, the larger or largest number of fractionation group was selected for the hospital. By this means, 48% of the hospitals were labeled as the 6-fraction group, 44% as 5- or 4-fraction group, and 8% as below 3 fraction group, as shown in the bottom of Fig. 2.

These results were rearranged by the number of beds in the hospitals. The majority were hospitals having more than 300 beds and this was about 40% of all hospitals, as shown in Fig. 3. Number of frac-

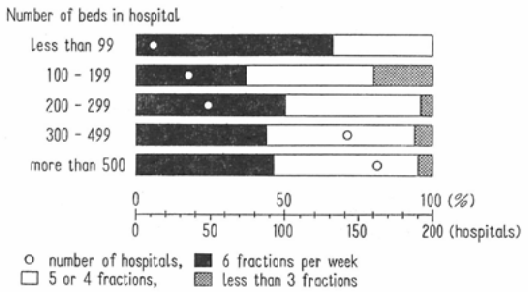


Fig. 3. Number of fractions per week and hospitals according to the total number of beds (7% was excluded).

tionations did not show definite correlation with the number of beds in hospitals. In the hospitals with less than 99 beds, 6-fraction group was the largest, being about 65%, and this was about 45% in other groups, although the number of hospitals with less than 99 beds comprised a small 2% of all hospitals. This suggests that the number of fractions per week does not depend on the number of beds in a hospital.

The dependency of the fractionation on the number of beds in the department of radiology is demonstrated in Fig. 4, showing a tendency for hospitals of 6-fraction group to decrease with increase in the number of beds. Hospitals of 6-fraction group without any bed were about 50%, being the maximum, and about 35%, being the minimum, in hospitals with more than 30 beds.

The relationship between the number of technicians and number of fractions per week is demonstrated in Fig. 5, which also shows the same tendency as the number of beds in the department of radiology.

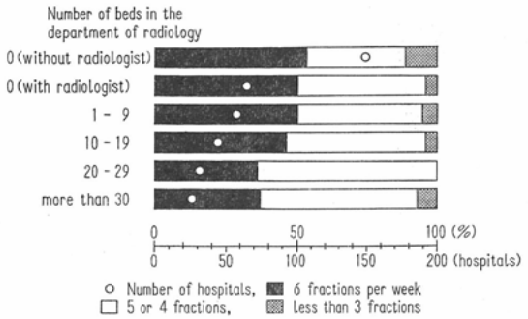
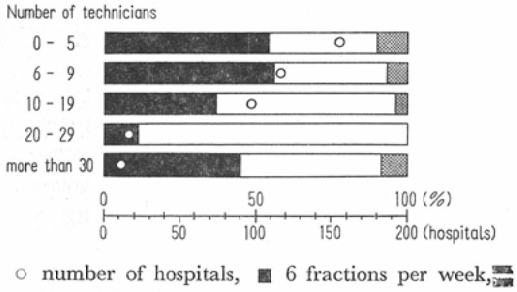


Fig. 4. Number of fractions per week and hospitals according to the number of beds in the department of radiology (11% was excluded).



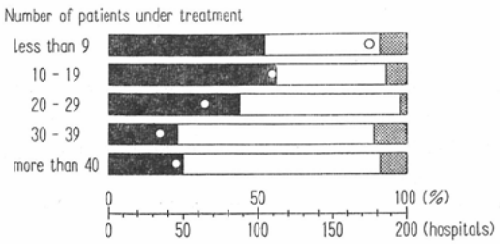
number of hospitals, 6 fractions per week,
5 or 4 fractions, less than 3 fractions

Fig. 5. Number of fractions per week and hospitals according to the number of technicians (3% was excluded).

Hospitals with less than 9 technicians were 55% (maximum) and those with more than 20 technicians were 30% (minimum) in the 6-fraction group. In Fig. 5, hospitals with more than 20 technicians was divided into two; those with 20–30 technicians and those more than 30 technicians. The situation is very different in these two groups but the number of hospitals was very small 5% of all hospitals.

Relation of the number of patients under treatment per hospital to weekly fractionations is demonstrated in Fig. 6 which shows the same tendency as in former two; where 55% of hospitals with less than 9 patients are 6-fraction group and about 25% of hospitals with more than 30 patients are also in 6-fraction group.

This dependency becomes clear according to the type of apparatus used. In stationary telecobalt group, about 65% were 6-fraction group and in high-energy accelerator with telecobalt, 25% were in this group, as demonstrated in Fig. 7. In this graph, high-energy accelerator with telecobalt is divided



number of hospitals, 6 fractions per week,
5 or 4 fractions, less than 3 fractions

Fig. 6. Number of fractions per week and hospitals according to the number of patient under treatment (2% was excluded).

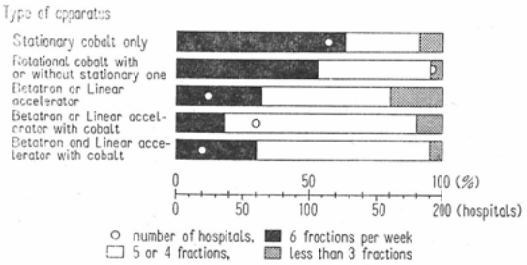


Fig. 7. Number of fractions per week and hospitals according to apparatus used. (2% was excluded)

into two groups but the number in these two groups is as small as 10% of all hospitals.

Classification according to the number of radiologists demonstrated this dependency most clearly as shown in Fig. 8, where about 55% of the hospitals without a radiologist were 6-fraction group and the percentage of 6-fraction group was below 20% in hospitals with more than 10 radiologists. In this graph,

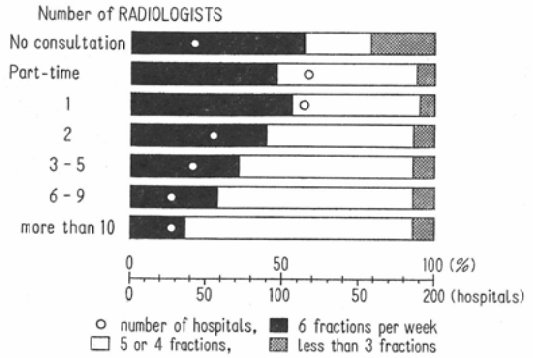


Fig. 8. Number of fractions per week and hospitals according to the number of radiologists (2% was excluded).

hospitals without a radiologist were divided into two; those without consultation with radiologists and those with part-time radiologists group.

These results suggest that fractionation is gradually changing from 6 fractions to 5 fractions per week, as departments of radiology become larger. The true reason for this change is not clear and is probably not due to biological basis but to some working conditions in Japan. Percentage of hospitals with markedly small number of fractions was not so large. There is no evidence at present whether 6 or 5 fractions are better. If 6000 rads were delivered at 1000 rads per week, the efficiency would be about 1680 rets by 6 fractions per week, 1760 rets by 5 fractions, and 2590 rets by 1 fraction. In other words, if 200 rads per fraction were delivered, the efficiency for 6000 rads would be 1790 rets in 6 fractions per week and 1760 rets in 5 fractions. Although the difference in rads would be only 2–5%, comparison of the effect in these two groups must be made with caution.

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