RESULTS OF RADIATION TREATMENT OF RETICULUM CELL SARCOMA, LYMPHOSARCOMA, GIANT FOLLICULAR LYMPHOMA AND HODGKIN'S DISEASE.

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細網肉腫，リンパ肉腫，巨大濾胞性リンパ腫及びホジキン氏病の放射線治療成績

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1946～1956の10年間に癌研放射線科において加療した細網肉腫，リンパ肉腫，巨大濾胞性リンパ腫及びホジキン氏病の180例の治療成績を調査し，治療方法と予後についての若干の考察を行つた．これらの疾患は一般に悪性リンパ腫と総称されるもので，5年生存率は180例中45例（25%）であつた．本症は頭頚部に原発するもが予後がよく，鎖骨より下部に原発したものには5年生存者が得られなかつた．治療方法は放射線療法が主体であるが，上顎原発のものにはデンケル氏手術を併用した．上咽頭原発のものにはX線外部照射と併用してRa管による腔内照射又はラドンシード挿入による内部照射も多く併用した．外部照射のみで成功した上咽頭および扁桃原発の本症では3000r/21日程度で大部分のものが良好な結果を得たが，これについても考察を加えた．照射野周辺の再燃が多かつたことから，照射野は更に大きくすることが必要であろうと考えられる．

During the decade from 1846 to 1946, 231 patients with reticulum cell sarcoma, lymphosarcoma, giant follicular lymphoma or Hodgkin's disease were admitted to our clinic for radiation therapy. Fifty-one patients of the 231 were excluded in the series of study because of the lack histological confirmation by our pathologists or because of the patient's refusal of

Table 1. Histological classification of our cases with malignant lymphoma and their five year survival rates.

Classification	Total No. of cases	Number of five year survivors (rate)
Reticulum Cell Sarcoma	161	41 (26%)
Lymphosarcoma	9	3 (30%)
Reticulolymphosarcoma	2	0
Giant Follicular Lymphoma	1	1
Malignant Lymphoma	5	0
Hodgkin's Disease	1	0
Total	180	45 (25%)

radiation therapy. Malignant tumors originating in lymphoid and reticuloendothelial cells are generally called malignant lymphoma or lymphoid tumor. The histological classification of our cases and their five year survival rates are shown in Table 1.

The frequency of reticulum cell sarcoma of our cases is more than 90 per cent and consequently that of the other malignant lymphomas is less than 10 per cent. The proportion of the various types of malignant lymphoma in this series is somewhat different from previous reports by other authors. It is not certain whether this descrepancy is due to the difference of races or the different concepts of pathologists. The number of the five year survivors after initiation of our treatment was 45 patients of 180, i. e. 25 per cent in the five year survival rate.

The purpose of this paper is to present our experiences in the radiation treatment of these patients and to give some suggestions on the new treatment of these diseases.

1. Age and Sex

The numerical distribution of age and sex is shown in Figure 1, including the number of five year survivors in each group. Although age distribution of breast cancer reveals normal distribution (mean age: 47±2, Yamashita & Kaneta), malignant lymphoma in the

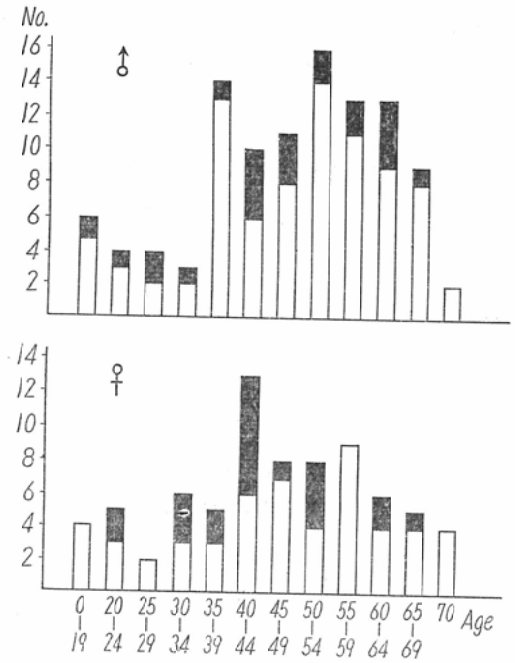

Figure 1. Age distribution of all our cases.
Number of the 5 year suvivors is shown in the dark area.

present series occurred in any age between the very young and the very old and its age distribution is not regarded as normal distribution.

There was only one five year survivor with malignant lymphoma out of 10 in both sexes

under nineteen years of age and none of 6 above seventy years of age. Although we had five year survivors out of 10 between forty and forty-four years of age in males and 7 of 13 in the same age group in females, this study did not reveal any significant prognostic influence of age, except for the fact that the very young and the very old did not do so well as those in the middle-age group. Incidence of malignant lymphoma in males was slightly larger than that of females and the sex ratio (male to female) was about 1.5 : 1. Table 2 shows the sex ratio and the five year survival rates. The propotion of five year survivors of females was slightly larger than that of males.

Table 2. Sex and five year survivors.

Sex	Total No. of cases	No. of five year survivors	Five year survival rate
Male	105	23	22%
Female	75	22	29%
Total	180	45	25%

2. Previous treatment

About one half of our patients with malignant lymphoma had received some treatment such as surgical operation, radiation therapy or chemotherapy before comming to our clinic and the ratio of five year survivors in this group of previously treated cases was almost the same as that in another group of new patients (Table 3). Since there were so many varieties in treatment among the previously treated patients of malignant lymphoma, it is impossible

Table 3. Previous treatment and five year survivors.

	Total	No. of five year survivors	Five year survival rate
Previously treated patients	81	20	25%
New patients	91	25	25%

to evaluate the result which is shown in Table 3.

3. Localization and Stage

As malignant lymphoma has many varieties and has many silent metastases, every previous author has stated that staging is rather difficult and may be inaccurate. In this paper the patients with malignant lymphoma are divided into three stages as follows :

Stage 1 : The lesion remains in the primary site or extends to one regional lymph node region.

Stage 2 : The lesion extends to two regional lymph node regions.

Stage 3 : The lesion extends to three or more regional lymph node regions, or has some distant metastases.

Our classification is almost equivalent to that of Murphy[5] and Kaplan[3]. The primary clinical localization is sometimes uncertain because of the simultaneous involvement of many lymph node regions without indicating a primary site or because of the appearently unrelated

foci of the disease.

The following two cases were designated as stage 3, and as "uncertain" as to the primary localization.

Case 1. T.K. 26 year old male. Laparotomy was performed on suspicion of appendicitis in 1954. Enlarged mesenteric lymph nodes were removed and microscopic examination revealed reticulum cell sarcoma. He was immediatly sent to our clinic for radiation treatment. Soon after the beginning of the postoperative irradiation to the abdomen, swelling of his right tonsil was found. Biopsy revealed also reticulum cell sarcoma. No metastases was found in the neck and chest. The involved tonsil was irradiated with a total tumor dose of 800 r in 12 days. Following this treatment, the patient has been free from clinical evidence of recurrence in the tonsil for more than 6 years, although he had metastases in the left inguinal region 2 years after the treatment. The inguinal metastases were also treated by roentgen irradiation. Consequently, the patient has been alive for more than 4 years without any clinical evidence of recurrence.

Case 2. S.T. 61 year old male. A tumor occupying the stomach was removed. Microscopic examination revealed reticulum cell sarcoma. Soon after the operation, enlarged tonsil was discovered and its histological diagnosis was the same. No other tumor was found in the neck or chest clinically.

The patient received roentgen therapy to the tonsil with a total tumor dose of 3000 r in 44 days. However, this patient had no postoperative roentgen therapy to the abdomen. The patient died 30 days after completion of the roentgen therapy to the tonsil. Cause of death was nuknown.

The course of the disease in each of these two cases seems to be consistent with the theory of multicentric origin of malignant lymphoma.

The primary clinical localization affects the outcome of the treatment as shown in Table 4. Although we had relatively high proportion of malignant lymphoma originating in the head and neck in the present series, the number of patients with primary localization in other parts of body was too small to allow any conclusion as to radiocurability in any particular localization.

In the 13 patients with reticulum cell sarcoma or lymphosarcoma originating in the maxillary antrum or nasal cavity, the number of five year survivors was 8 among 9 of stage 1 patients (88 per cent) and was none among 4 of stage 3 patients. In the 113 patients with reticulum cell sarcoma, lymyhosarcoma or giant follicular lymphoma originating in the nasopharynx or tonsil, five year survival rate of the stage 1 patients was 49 per cent (25 of 53 patients), that of the stage 2 patients 19 per cent (3 of 16 patients) and that of the stage 3 patients 11 per cent (5 of 44 patients). Among 26 malignant lymphoma patients (one of them was Hodgkin's disease, the others were reticulum cell sarcoma or lymphosarcoma) with primary clinical localization in the cervical or supraclavicular region, we had only one lymphosarcoma patient in stage 1 who was alive for more than five years after the initiation of treatment. Of the 28 patients with reticulum cell sarcoma or lymphosarcoma originating in other parts of body, we had only 3 patients, or 10.7 per cent, who were alive for more than five years after our initial treatment.

Table 4. Localization and clinical staging of the malignant lymphoma cases and their five year survivors by radiation treatment.

Localization	Stage 1	Stage 2	Stage 3
Maxillary antrum or nasal cavity	8 of 9 (88%)	0	0 of 4 (0%)
Nasopharynx or tonsil	25 of 53 (49%)	3 of 16(19%)	5 of 44(11%)
Cervical or supraclavicular lymph nodes	1 of 6 (17%)	0 of 5(0%)	0 of 15(0%)
Thyroid gland	1 of 1(100%)	0	0
Axillary lymph nodes	0 of 1 (0%)	0	0 of 2(0%)
Inguinal lymph nodes	0 of 1 (0%)	0	0 of 1(0%)
Mediastinum	0	0	0 of 2(0%)
Small intestine or colon	0	0 of 2(0%)	0
Skin	0	0	0 of 3(0%)
Miscellaneus	0	0	0 of 3(0%)
Uncertain	0	0	2 of 12(17%)
Total	35 of 71 (49%)	3 of 23(13%)	7 of 86(8%)

4. Type of treatment

The treatment consisted mainly of roentgen therapy solely directed to the clinically involved region. But, sometimes it was done in combination with other types of treatment, such as surgical operation, radium therapy, implantation of radon-seeds and chemotherapy. The stage 1 or stage 2 patients were treated radically in the hope of eliminating the disease and stage 3 patients were treated symptomatically. Chemotherapeutica, such as nitromin, tespamin etc. were used only for the patients in whom the condition was advanced.

The type of treatment differed somewhat depending upon the primary site of the disease. Most patients with primary clinical localization in the maxillary antrum were treated by Denker's operation followed by intracavitary irradiation with radium tube and external X-ray irradiation. Many patients whose tumor was localized in the nasal cavity received intracavital irradiation with radium into the nasal cavity followed by external X-ray irradiation. In some patients with primary clinical localization in the nasopharynx or tonsil, implantation of radon-seeds was carried out before and after external irradiation. If some residual involvement was seen in the irradiated lymph node area, additional short distanced irradiation using radium was given to the area in the present series.

The quality of X-rays used in the present series represented a half value layer of 0.9~1.0 mm Cu. F.S.D. was 40 cm. The daily dose was 200~300 r in air. Radiation fields were varied depending on the site of origin and on the extention of the disease. To the patients having involvement in the maxillary antrum, approximately 200 r in air to each of two 6×8

cm fields over an anterior and lateral aspects of the face was administered per day. To the patients whose nasopharynx or tonsil was involved, about 200 r in air was given daily through each of bilateral 10×15 cm fields or 8×8 cm fields. A 10×15 cm field was used generally when the primary site and the regional lymph node region were to be irradiated altogether. When the involved site was located in the deep region, as in the abdomen, roentgen sieve therapy was employed. The total tumor dose was varied depending upon the individual sensitivity of the lesion being irradiated.

5. Result of treatment

Among the 180 patients receiving radiation treatment for malignant lymphoma, the number of the five year survivors was 45, or 25 per cent in the five year survival rate. 42 cases were free from clinical evidence of tumor for five years after our initial treatment while 3 patients lived with tumor 30 five.

Thirty 5 year survivors, or 67 per cent of 45, had shown neither recurrence nor metastases after a single course of our treatment. The proportion of five year survivors in each histological classification is shown in Table 2; 26 per cent of 161 reticulum cell sarcoma patients survived five years after the start of our treatment, 33 per cent of 9 lymphosarcoma patients lived for five years and the only one patient with giant follicular lymphoma in the present series survived five years after the start of our treatment. We had only one patient with Hodgkin's disease in the present series but this patient died within five years after our initial treatment.

Rosenberg et al.[9] stated that among the patients with giant follicular lymphoma, lymphosarcoma and reticulum cell sarcoma the best prognosis was in giant follicular lymphoma followed by lymphosarcoma and reticulum cell sarcoma in order. Although the number of patients with lymphosarcoma, Hodgkin's disease and giant follicular lymphoma is too small in the present series to make any prognostic conclusion on the basis of the microscopic character, it is also seen in our present series that the prognosis was better in lymphosarcoma than in reticulum cell sarcoma. As previously stated, many of our patients with lymphosarcoma originating in the maxillary antrum, nasal cavity, nasopharynx or tonsil showed favorable response to our treatment. we had, however, no five year survivors with malignant lymphoma originating in the axillary lymph node, mediastinum or inguinal lymph node regions.

This fact may be due to the natural tendency of malignant lymphoma clinically originating in the head to represent a slowly advancing type of lesion.

Although most of the malignant lymphoma patients whose metastases arose after the completion of our initial treatment could not expect to live for long, five year survivors of 45, or 9 per cent, overcame their metastases and the other 2 five year survivors, or 4 per cent of 45, were alive for more than five years with those metastases. Two of these patients are described briefly as follows:

Case 3. T.O. In 1955, 46 year old male developed reticulum cell sarcoma of the nasopharynx with a cervical metastasis 2 cm in diameter. Roentgen therapy administered with a total tumor dose of 3040 r in 19 days using bilateral 8×10 cm fields. A 10 mg radium tube was inserted

into the nasopharynx for 20 hours one month after the roentgen therapy, The patient received a second course of roentgen therapy in the same place one more month later. Six months later, a 2 cm clinical metastasis was discovered in the right inguinal region. The tumor disappeared after irradiation of X-rays with a total tumor dose of 3400 r in 22 days. Subsequently, he has lived more than 11 years without recurrence or metastasis.

Case 4. K.H. A 20 year old female developed reticulum cell sarcoma of the right tonsil. This patient noticed swelling of both tonsils before comming to our clinic and bilateral tonsillectomy was performed without any suspicion of cancer in another hospital in 1954. One month after operation, a thumb-tip-sized tumor was found in the right upper cervical region and the right side of the oropharynx was found to be tumor-like infiltrated with tumor. Biopsy proved reticulum cell sarcoma. The pharyngeal tumor was irradiated together with cervical metastases through two bilateral 10×15 cm fields. A total tumor dose of 3000 r in 33 days was administered by roentgen therapy. Three years later, she had metastases in the right preauricular region. Four years later, she had metastases in the right hypogastric region. The former was controled successfully by radium treatment, but the latter continued growing slowly. The patient died probably of the disease 5. 5 years after the initial treatment.

Reviewing the six patients who had metastases after the completion of their initial treatment and who survived more than five years, two revealed metastases in the cervical region ; one, six months later and the other, four years later. The third patient had metastases in the retroauricular region soon after the initial radiotherapy. The other three patients had metastases in the inguinal region, six months later, one year later and four years later, respectively.

Three types of exacerbation which may terminate the remission following the first course of treatment are 1) recurrence, 2) extension*) and 3) delayed metastases. In order to find the causes of failure in our treatments, 41 patients with exacerbations were studied on the following points : 1) which type of exacerbation occurred first ? and 2) where did it occur ? The 41 patients consisted of stage 1 or stage 2 malignat lymphoma originating in the nasopharynx or tonsil. Among them, 39 patients died within 5 years after the start of our treatment and 2 patients were lost to follow-up.

Table 5. Primary types of exacerbation

I. Recurrence		7
II. Extension*)		14
	Base of the skull	3
	Temporal region	1
	Supraclavicular region	6
	Others	4
III. Delayed metastases		10
	Mdiastinum	1
	Axillary nodes	2
	Abdomen	3
	Inguinal nodes	2
	Many placess simultaneously	2
IV. Unknown		10

* The term "extension" is used with the same meanning as by Kaplan[3].

There were 7 patients whose recurrences were the first evidence among the three types of exacerbation and 14 patients whose extensions were the first. Delayed metastasis occurred first in 10 patients. The type of exacerbation in other 10 patients is unknown. The details are shown in Table 5. Although the accuracy of the data shown in Table 5 is limitted by reason of

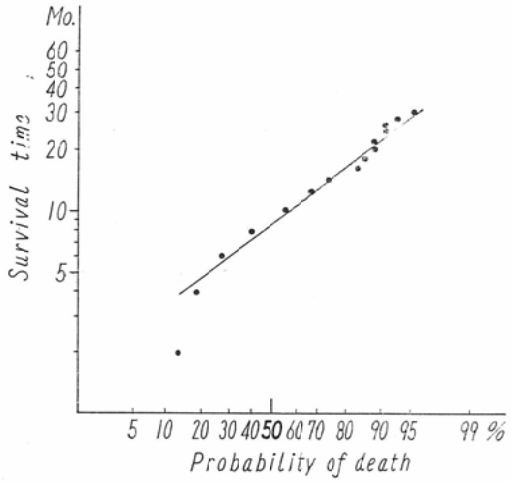

Figure 2. Life expectancy of 39 stage 1 or stage 2patients died with malignant lymphoma originating in the naoopharynx or tonsil after the initiation of radiation therapy.

the fact that metastases are difficult to find when they were located deep in the body, we had only seven patients showing recurrence as the first sign of generalization compared to 14 patients showing extension to the surrounding tissue outside the radiation field. This fact would indicate that the radiation fields should have been larger than in this series in order to cover the area most likely to have silent metastases and that the great majority of our failures were due to the narrowness of the radiation field rather than inadequate amount of radiation dosage. The mean survival time of 39 patients died with malignant lymphoma in stage 1 or stage 2 with primary localization in the nasopharynx or tonsil who died of fhe disease within five years after initiation of therapy, was studied by plotting the individual survival time after start of our therapy on logarithmic probability paper (Figure 2). As Figure 2 shows, lineality was found between survival time and percentage of the cumulative number of death in every two month periods after the initial treatment.

Mean survival time among these patients was 10 months after start of our therapy, and 80 per cent of patients of the group died of the disease within 16 months after start of our therapy.

If the number of five year survivors with similar localized disease were added to the number of the dead patients with the same condition, it will turn out that only 5 per cent of these patients died during the period from 16 months to 5 years after our initial treatment.

In order to find an adequate tumor dose to destroy malignant lymphoma, individual total

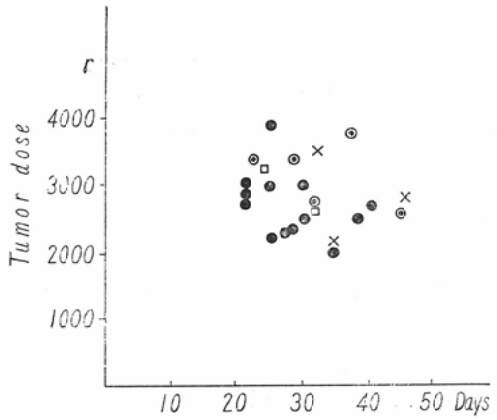

Figure 3. Time-dose relationship

● Alive more than 5 years without recurrence or metastasis.
⊙ No recurrence untill they died of their metastasis 6 months or more after the start of our treatments.
× Recurrence
□ Re-growth in the irradiated lymph node region.

tumor doses given to the group of 23 patients with disease localized in the nasopharynx or tonsil and who received only one course of external roentgen therapy was plotted on Figure 3 indicating success or failure.

Among these 23 patients, 13 were alive more than 5 years without recurrence or metstasis, 5 had no recurrence until they died of their metastases 6 months or more after the start of our treatments, 3 had recurrences and 2 had no recurrence in the primary tissue but revealed re-growths in the irradiated lymph node regions.

As shown in Figure 3, the total tumor dose of the successfully treated patients varied widely from 2000 r in 34 days to 3800 r in 23 days. However, the dots showing failure were mixd among those symbolizing success. An optimum time-dose relationship for malignant lymphoma was consequently not indicated from this figure. Reasons for this will be discussed later.

Discussion

Our observation clearly demonstrates that the prognosis is better in the patients with malignant lymphoma originating in the head and neck than in other parts of the body. This is in agreement with Molme & Kunkler[6]. They had no five year survivors among their reticulosis patients with primary localization in the axillary lymph nodes, abdomen, bone or skin. Lenz et al.[4] described, however, that the proportion of five year symptom free survivors was nearly 20 per cent among patients with localized lymphosarcoma originating in cervical, axillary, inguinal lymph nodes, naso-pharynx, stomach and intestine. Lenz also reported that 15 of 19 five year symptom free lymphosarcoma patients whose primary localization was in the cervical region and 2 of 4 patients with the primary site in the stomach were irradiated postoperatively. According to the same authors, among their 15 localized lymphosarcoma patients originating in the tonsil, 7 were alive symptom free for more than

fiive years.

Among our 180 patients with malignant lymphoma, several represented a slowly advancing type of lesion. Gretner[2] stated that 34 of 66 lymphosarcoma patients followed a rapid clinical course and 32 of 66 progressed slowly. Although we could not divide our patients into "Schnelle Verlaufsform" and "Langsame Verlaufsform" as Gretner, we had, rather, many indications of a natural tendency to progress slowly, some of these examples are as follows: 1). Two patients with reticulum cell sarcoma of the cervical region were given roentgen therapy. They became symptom free. Two years later reticulum cell sarcoma was discovered again in the nasopharynx. They were alive for more than five years after further radiation therapy. 2). As previously described, 6 patients with reticulum cell sarcoma, lymphosarcoma and giant follicular lymphoma were alive more than five years even though they had delayed metastases after the initial treatment. 3). One stage 3 lymphosarcoma patient whose involvement was in three unrelated lymph node regions survived more than five years without clinical evidence of disease after radiation therapy. 4). As shown in case 1, one reticulum cell sarcoma patient with clinical involvement both in mesentric lymph nodes and tonsil was symptom free for more than five years after roentgen therapy. 5). Among 44 stage 3 patients with malignant lymphoma originating in the pharynx, 5 patients were alive more than five years after radiation therapy.

Although Lenz et al.[4] stated that these patients whose conditions progressed slowly did not become free of symptoms and eventually died of the disease, we feel that a possibility exists that local radiation therapy may overcome the disease that advances slowly and insidously.

Based on microscopic character, as previously stated in this paper, the results in giant follicular lymphoma were best, the results in lymphosarcoma were second and the results in reticulum cell sarcoma were worst.

Tsukamoto[10] and Nicholes et al.[7] treied to find some prognostic value regarding histological grading in reticulum cell sarcoma and lymphosarcoma. It seems that there is a noticeable discrepancy between these authors. Although we did not study this problem at this time, further studies of this problem will be necessary.

The results shown in figure 3 concernning tumor dose requirments of reticulum cell sarcoma and lymphosarcoma did not reveal any distinct relationship between adequate tumor dose and over-all time. Several reasons accounting for the above fact are as follows: 1). Each reticulum cell sarcoma and lymphosarcoma very likely has its own radiosensitivity. 2). Although only patients with stage 1 or stage 2 reticulum cell sarcoma or lymphosarcoma were used for this investigation, some of them may have had silent metastases beyond the radiation fields, some of which may have been the cause of the patient's death. 3). The size of the localized lesion or involved lymph node may influence the tumor dose requirements. as Lenz et al[4] stated. 4). Each total tumor dose plotted on figure 3 represents a minimum dose rather than the adequate dose for cure.

Judging from the result shown in Figure 3, 21 patients out of all 23 would have been successfully treated with roentgen therapy, if they had been administered equally a tumor

dose of 3000 r within 21 days.

We frequently experienced, on the other hand, that the response of the tumor to the initial course of roentgen therapy was not favorable and that other treatment such as operation, implantation of radon-seeds, short distanced radiation using radium tube or another course of roentgen therapy were required.

Consequently, it may be said that the data plotted in Figure 3 is obtained from the group of patients with relatively radiosensitive tumors. Based on these findings, it will be best to administer a tumor dose of 3500 r within 21 days to 4000 r within 28 days, if possible. An adequate tumor dose for malignant lymphoma is recommended by preavious authors as follows: 4000～5000 r in 6 weeks(Lenz et al[4].), 4000～5000 r in 4～4.5 weeks (Coley et al[1]), 3500～4000 rads in 3～4 weeks for Hodgkin's disease (Kaplan[3]), 3500～4000 r in 3 weeks (Paterson[8]).3000 r in 4 weeks (Molme & Kunkler[6]), 2000 r in 2 weeks for stage 1, 3000 r in 3 weeks for stage 2 (Nicholes at al[7]), and 2250～2400 r in 20 days (Gretner[2]). The importance of large radiation fields in roentgen therapy of malignant lymphoma is well recognized. Among our patients in this series, when regional lymph nodes were free from the tumor at the start of roentgen therapy, the tumor in the primary site was previously irradiated through one or two 8×8cm fields; when regional lymphnodes were involved, one or two 10×15 cm fields were used in order to include both sites of the lesion. In our observation (see Table 5) we had more patients who developed extention around the radiation fields than patients who developed recurrence. This result suggests that more attention should be paid to broadening the radiation field. It is our impression that the tolerance dose for Japanese patients may be lower than that for western patients. We have found that several patients did not tolerate a radiation dose of about 3500 r within 21 days with bilateral 10×15 cm fields. Since a larger tumor requires a higher radiation dose to destroy it than a smaller tumor, if a tumor is too large in size, it is reasonable to utilize implantation of radon-seeds into the main tumor after or during the course of roentgen therapy using large radiation fields. In order to decrease the volume dose received by the patient with malignant lymphoma, supervoltage technique is also recommended. Kaplan[3] reported favorable results in the treatment of Hodgkin's disease utilizing linear accelerator X-ray therapy with large radiation fields.

Summary

Malignant lymphomas were treated primarily with roentgen therapy, in addition to which operation, radium tubing and radon-seeds implantation were used successfully in some cases depending upon the condition of the primary localization. Of 180 patients in the present series, we had only one Hodgkin's disease arising in the supraclavicular region and only one giant follicular lymphoma. The others were either reticulum cell sarcoma or lymphosarcoma. More than 90 per cent of our 180 patients with malignant lymphoma had reticulum cell sarcoma. Concernning prognostic value of the primary localization of malignant lymphoma, the disease originating in the maxillary antrum or nasal cavity showed the best prognosis and that originating in the nasopharynx or tonsil had the second best prognosis. Better prognosis may be mainly due to the natural tendency of the individual tumor origi-

nating in the maxillary antrum, nasal cavity, nasopharynx and tonsil to grow slowly. Malignant lymphoma originating in other parts of the body showed a poor prognosis. Most of the malignant lymphoma patients with the clinically primary localization in the maxillary antrum were treated by operation followed by internal irradiation with radium tube and external roentgen therapy. Most of the malignant lymphoma patients with tumors originating in the nasopharynx or tonsil were treated with roentgen therapy and in some patients were followed by radon-seeds implantation in the residual tumor. The mean survival time of the malignant lymphoma patients in stage 1 or stage 2 with clinically primary localization in the nasopharynx or tonsil who died of the disease within 5 years was 10 months after the initiation of therapy. An adequate total tumor dose for the disease was considered to be 3500～4000 r in 21～28 days. Large radiation fields were also recommended by the authors.

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