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FINAL REPORT

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THE USE OF GAMMA RAYS AS A THERAPEUTIC AGENT IN CARCINOMA

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THE USE OF GAMMA RAYS AS A THERAPEUTIC AGENT IN CARCINOMA

The renewed interest in the surgical treatment of cancer of the cervix again raises the fundamental question - should cancer of the cervix be treated by operation or irradiation? Actually the question is not so fundamental as it seems. Certainly in Stage 0 lesions (League of Nations classification), there is little need for treatment by irradiation since cure can be effected in practically all cases by complete hysterectomy. In Stage I lesions the surgeons and the radiotherapists have little to quibble over since each does a creditable job providing one accepts a cure-rate of 70 to 80 per cent as good. In Stage II lesions there seemingly is really not much to argue about since the cure-rate averages about 50 per cent by either method of therapy. From this point on the radiotherapists have the better of the argument because few surgeons, excepting of course the evisceration minded ones, see any good reason for trying to remove the uterus and pelvic lymph nodes when the disease has extended laterally to the pelvic walls on one or both sides (Stage III), or has invaded the bladder and rectum (Stage IV). No specific and direct answer seems possible, therefore, to the question. Both methods of treatment manifestly have their place.

One striking fact, bearing on this question, does emerge when attention is given to the reasons for failure in the earlier lesions. Few patients are saved by operation when the lymph nodes are positive ⁽¹⁾, and recurrences in irradiated patients are found frequently in the lateral parametrium. This suggests that the tumor cells were already outside the effective area of irradiation or operation at the time of treatment. It seems reasonable to suppose, therefore, that the same patients are being lost by either method. If this supposition is correct better results can be expected only by more extensive operation or more adequate irradiation of the pelvic lymph nodes. Actually there seems little reason to believe that the radical Wertheim has much more to offer now than in the past beyond a significant decrease in primary operative mortality. Pelvic evisceration with extensive lymphadenectomy might give better results for the primary treatment of the disease but it requires great fortitude to recommend so mutilating a procedure as this when other approaches may be safer, less devastating and perhaps more satisfactory. It would seem that improvements in the treatment of this disease are more likely to be found in methods giving better irradiation of the pelvic lymph nodes than in more and more radical operations. With this in mind we embarked on a study of the effects of irradiation of the parametrium with radioactive colloidal gold.

Radioactive gold has several properties which should make it an effective agent for irradiation of the parametrium. First and most important is the short half-life of 2.8 days and second, 90 per cent of the activity is in the form of beta particles and only 10 per cent in gamma rays. The short half-life makes interstitial injection feasible and the high content of beta irradiation means that the majority of the effects will be manifest only in the immediate vicinity of the gold. Finally, the particles of gold in the colloidal form are so small that they should enter the lymphatics and be filtered out by the reticulo-endothelium system of the lymph nodes. The radioactive material should be found then in the very same areas as the tumor

cells, namely the regional lymph nodes. Preliminary work in animals has shown that each of these particular properties does make radiogold a desirable agent for use in cancer of the cervix. (2) When injected directly into experimental tumors in mice sufficient irradiation was obtained locally to eradicate the tumor without killing the mouse from total body irradiation. When injected either subcutaneously or parametrically in rabbits the radioactive material accumulated promptly in the regional lymph nodes. (3) These favorable results in animals led us directly to the study of the gold as an agent for irradiation of the parametrium in women with cancer of the cervix.

The first problem that had to be faced in the use of radiogold in the woman with cancer of the cervix was that of deciding whether the new agent should be used first in advanced and hopeless cases where no harm and little good could be expected or in early invasive lesions where cures might be expected. We chose the latter, feeling that only in such early cases could we find out quickly whether the radiogold would concentrate in the pelvic lymph nodes following transvaginal parametrial injection. A few patients were selected initially in whom a radical Wertheim hysterectomy and pelvic lymphadenectomy seemed to offer as good a chance for cure as treatment with X-ray and radium. These patients were injected pre-operatively with tracer quantities of radioactive gold. (4) Examination of the lymph nodes and loose parametrial tissue removed at operation showed that the gold was found in macrophages in the parametrial tissue and in the reticulo-endothelial cells of the lymph nodes, and that all lymph nodes including the most inferior and superior of the external iliac nodes were radioactive. Also very little of the injected radiogold appeared in the circulating blood. These experiments showed that the pelvic lymph nodes could be irradiated by this agent but they did not show whether adequate irradiation to destroy cancer cells in the lymph nodes could be achieved safely.

The next step in the study was to determine whether adequate irradiation could be achieved in the lymph nodes to destroy tumor cells without producing excessive damage to normal structures such as the bladder, rectum, ureters and pelvic nerves. For this part of the study early Stage I cases were treated with gradually increasing amounts of radiogold, each followed by pelvic lymphadenectomy and radical Wertheim hysterectomy. It soon became apparent that dosages of 50 millicuries in each parametrium were not especially hazardous and that the lymph nodes obtained following this amount of irradiation showed cytological evidence of profound irradiation. We were fortunate too in finding a few patients early in the study with positive lymph nodes in which the tumor cells showed the typical effects of irradiation. In a group of 24 cases the amount of irradiation which the various lymph nodes received was determined by measuring the gamma radioactivity with a scintillation counter in nodes removed at operation. From this value the total amount of beta irradiation was calculated. (Table I) The quantity of irradiation is given as r.e.p. per gram of nodal tissue. It is not permissible to consider a r.e.p. as a roentgen (r) for gamma rays or X-rays since the relative biological effectiveness of r.e.p. and r for cancer of the cervix has not been fully determined.

However, even assuming a ratio of two or even three r.e.p. equivalent to one r, it is evident that most of the nodes removed received much more irradiation than is usually achieved by conventional treatment with X-ray and radium. Furthermore, numerous lymph nodes were obtained which contained 'dead' appearing tumor cells.

The localization of the gold and the distribution of radiation in the pelvis has been studied by several different methods.⁽⁵⁾ Diodrast was added to the radioactive solution and X-ray films were made immediately after injection. These pictures show that the entire parametrium and the node-bearing regions were diffusely infiltrated when 30 to 40 cc. of solution were injected on each side. The next step was to show that the radioactivity remained in the same region. Measurements with a scintiscanner, repeated several times during the first two weeks after injection, showed that the radioactivity remained unchanged in the area of injection except for decreasing intensity due to natural decay of the radiogold. Measurements of the total activity of the uterus, tubes, ovaries, lymph nodes and attached tissues removed at operation indicate, on the other hand, that only about 30 to 50 per cent of the expected activity remains in the structures removed at operation. It is evident, therefore, that there must be considerable spread of the radiogold into tissues beyond the operative area. This, of course, is desirable. Other studies have shown that the lymph nodes contain more radioactivity per gram than does the areolar and fatty tissue surrounding the nodes. Studies in animals have shown that the radiogold begins to appear in the lymph nodes within a few hours after injection. All this evidence indicates that this method of irradiating the parametria and pelvic lymph nodes should be effective.

In actual treatment of individual cases, especially those in which maximum dosages of radium were to be given, it was, of course, necessary to measure the contribution of the gamma component of the radiogold. These measurements were made in most patients with a scintillation, probe-type counter inserted into the bladder and rectum as soon as the radiogold had been injected. Such measurements indicate that when 50 to 65 millicuries are injected into each parametrium, the bladder, rectum and cervix will receive about 1200 r, whereas the mid parametrium on each side will receive about 2200 r. These values do not, of course, include the irradiation contributed locally by the beta component. Similar measurements were made at the time of each radium application, making it possible to approximate, at least, the total amount of gamma irradiation delivered to virtually any area of the pelvis. When two radium applications are made it is apparent that the entire pelvic region received a fairly effective dose of irradiation and that this amount can be achieved without over-irradiating the cervix, bladder and rectum. (Table II).

The results obtained are based upon the study of three distinct and separate groups of Stage I, II and III cases, treated during the years 1950-53, inclusive. The first group contains all patients (116) in whom the parametrium was irradiated by the transvaginal injection of radiogold. In many patients of this group the cervix was also treated with radium. In 70 of these patients radical

hysterectomy and pelvic lymphadenectomy were done following completion of the irradiation. All patients not subjected to hysterectomy received full radium treatment of the cervix. The second group contains all clinic patients (126) treated with deep X-ray and radium during the same period of time. The third group contains all private patients (132) of one of us treated with X-ray and radium during the same period. The exact details of the X-ray and radium treatment in the second and third groups need not be given since the dosages varied somewhat. The X-ray was given usually through four portals with an average skin dose in air of 2000 to 2500 r through each port with a 200 kv source. In many cases the radium was applied in a fixed tandem ovoid type of colpostat (6) and in the others a tandem and vaginal ovoids were used. The approximate maximum amount delivered to point B of the Manchester system (7) from the radium was 3500 r. The cases are tabulated, by stage, for each period of one year so that the survival rates can be calculated. Since the study of the radiogold has not been carried on for quite five years, there are as yet no five year survival rates.

During the four year period 63 patients with Stage I lesions have been treated with radiogold. Additional treatment consisted of Wertheim hysterectomy and pelvic lymphadenectomy in 30; radium, hysterectomy and lymphadenectomy in 21; and radium only in 12. At the present time 58 (92.1 %) are alive and presumed to be free of disease. During this same period of time 51 private patients were treated with X-ray and radium, of whom 41 (80.4%) are alive, and 32 clinic patients, of whom 22 (68.8%) are alive and apparently free of disease. (Table III)

Very few patients with Stage II lesions received radiogold in the first two years of the study. However, after observing the good results obtained in Stage I lesions and a few Stage II lesions, many more of the Stage II lesions were treated with radiogold. This explains the increasing number receiving gold in 1952 and 1953 and the decreasing number in the clinic group receiving X-ray and radium. In this group of 37 patients treated with radiogold, there are 33 (89.3%) who are alive and with no evidence of disease. During this same period 54 clinic patients were treated with X-ray and radium, of whom 26 (48.1%) are alive without evidence of disease and 68 private patients of whom 35 (56.5%) are alive without evidence of disease. (Table IV) In this stage also, the survival rate of the patients treated in any year of the study is considerably greater among those treated with gold than in either the clinic or private patients treated with X-ray and radium.

In view of the seemingly good results obtained in Stage II lesions during the year 1952, 12 patients with Stage III lesions were treated with radiogold and radium in 1953. Of these, nine (75%) are alive. This is in contrast to 11 clinic patients treated during the same year with X-ray and radium, of whom only five are alive (45.5%). It would seem, therefore, that the results in Stage III lesions may be better than those obtained with X-ray and radium. (Table V)

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A more significant arrangement of the data, in so far as ultimate survival may be concerned, obviously would be obtained if only those patients in the three groups, who were treated two or more years ago, are considered. Limiting the data in this manner reduces the number of patients treated with radiogold to 35 Stage I lesions, nine with Stage II lesions and two with Stage III lesions. It is quite evident that the 2 to 4 1/2 year survival rates in both Stage I and Stage II lesions are much better in the series treated with radiogold than in the series treated with X-ray and radium. (Table VI)

It may be argued that the better results obtained in Stage I and Stage II lesions in the radiogold series, may have been due to the selection of more favorable cases. To a certain extent this may be true since the better operative risks were selected for the group to receive gold. The average weight of those clinic patients receiving X-ray and radium was 146 pounds (89 - 245), whereas the average weight of those receiving radiogold was 141 (102 - 230). Likewise, the average age of those receiving X-ray and radium was 47.2 years (19 - 78), whereas the average age of those receiving radiogold was 39.3 (23 - 63). These data tend to support the probability that the more favorable cases fell in the series receiving gold.

In the compilation of results given above no attempt was made to so tabulate the results that some opinion might be formulated regarding the desirability of completing the therapy with radical Wertheim hysterectomy and pelvic lymphadenectomy. First of all, it should be pointed out that the radical operation was deemed necessary at the beginning of the study to be as certain as possible that the disease was being treated adequately even though the radiogold might prove useless. It soon became apparent that better results were being obtained in those patients treated with radiogold followed by operation than in those treated by X-ray and radium. It seemed imperative, therefore, to continue operating on all patients with Stage I and Stage II lesions who were good operative risks. This plan is still being followed. However, there are enough patients now who, for one reason or another, have been treated exclusively with radiogold and radium to warrant some comparison of results obtained in operated and non-operated patients treated with radiogold.

Three different procedures are used in treating patients with radiogold:- radiogold and operation; radiogold, radium and operation; and, radiogold and radium but without operation. (Table VII) In 30 Stage I lesions treatment consisted of the parametrial injection of radiogold followed by Wertheim hysterectomy and pelvic lymphadenectomy. Of this group 27 (90%) are alive and apparently free of disease. The three deaths all occurred in less than eight months presumably from carcinomatosis. There were also 21 Stage I lesions, each treated with radiogold, at least one application of radium and finally by operation. Of these 20 (95.2%) are alive.

Finally, 12 Stage I lesions were treated with radiogold and radium, but no operation was done. Eleven (91.7%) of these patients are alive. There were 18 patients with Stage II lesions who were treated with radiogold and radium but who were not subjected to operation. Only one of these patients has died thus far of the disease but another one has pulmonary metastases. There were also 18 patients who received radium and were subjected to operation. One of these has died and another has pulmonary metastases. The number in each group is too small to warrant any major conclusion. However, it seems probable that the cervix should be treated with radium prior to operation even in early cases. This is further substantiated by the fact that these patients, subjected to operation without radium treatment of the cervix, had generally smaller and earlier appearing lesions of the cervix, but despite this the results were probably not as good as in the more advanced Stage I lesions which were treated by radium prior to operation. Also the Stage II lesions seemed to do as well when treated with radiogold and radium as when treated with radiogold, radium and operation.

The 70 operated cases also provide considerable information regarding frequency with which positive lymph nodes were found. In the 51 Stage I lesions treated by radiogold and operation, there were five (9.8%) with positive lymph nodes. Four of these five are alive and show no evidence of recurrence, and one has died of generalized carcinomatosis. Of the 19 Stage II lesions treated with radiogold and operation, there were six (31.5%) with positive nodes. Of these six, one has died, another has a pulmonary metastasis and the remaining four are alive without evidence of recurrence. (Table VIII) One wonders, of course, whether the irradiation has reduced the incidence of positive nodes. The only information bearing on this question in this study is to be found in the examination of the lymph nodes. Many lymph nodes obviously contained tumor cells but there were other nodes in which there were numerous areas of hyaline degeneration suggestive of total destruction of small collections of tumor cells. Such nodes have been considered as possibly positive prior to irradiation. The addition of those cases with questionably positive nodes to those cases with definitely positive nodes produces some very interesting data regarding the presumed incidence of positive nodes in both Stage I and Stage II lesions. There were six Stage I lesions and five Stage II lesions with questionably positive nodes. When these were added to the 11 cases with definitely positive nodes the incidence of nodes presumed positive prior to treatment becomes 21.6 per cent in Stage I lesions and 57.9 per cent in Stage II lesions. These figures lend some credence to the idea that the determining factor in the success or failure of X-ray and radium treatment is the presence or absence of lymph node involvement prior to treatment.

This study also has provided a good opportunity to ascertain how much irradiation is necessary to destroy tumor cells within the cervix itself. There were 22 operated cases in which the radium applications were such that the actual dose delivered to a point 1 cm. lateral to the external os could be calculated with reasonably accuracy. This amount, plus that derived from the gamma component of the radiogold, was correlated in the cases subjected to hysterectomy with the

presence or absence of tumor cells in the cervix. (Table IX) The results indicate that a total dose of 8,000 to 10,000 r delivered to the cervix over a period of four weeks is enough to eradicate the primary tumor, when the lesion is squamous cell in type. There were too few adenocarcinomas (only 5) in the series to warrant any conclusion beyond stating that 8,000 to 10,000 r did not destroy the primary tumor in four cases. Whereas, 12,000 r did destroy the tumor in one case. These observations are in general agreement with the accepted ideas regarding the amount of irradiation necessary to destroy squamous cell cancer of the cervix.

Finally, a few words need to be said regarding the complications produced by the treatment with radiogold. Many patients have complained of aching pain in the hips, low back and legs. Usually these symptoms have disappeared within two to three weeks, although in a few patients the neuritic pain has persisted for four or five months. In some patients there was weakness of the anal sphincter but no patient has developed incontinence of feces. Serious genito-urinary complications have developed in three patients. Each of these patients received radiogold and radium followed by Wertheim hysterectomy and pelvic lymphadenectomy, and in each the clinical course was similar up to a certain point. The post-operative convalescence was uneventful for about a week. Then there began a long chain of events marked by fever, lower abdominal pain, parametrial induration and ultimately by a uretero-vaginal fistula in one patient, a vesico-vaginal fistula in another patient, and a uretero-recto-vaginal fistula in the third. The vesico-vaginal fistula has been repaired. The other two patients have had the ureters transplanted to a loop of small bowel (ileal bladder) and in one of these a colostomy also was done. In none of these three patients was there any evidence that the fistulae were due to either persistence or recurrence of the tumor. It is pertinent to point out that the three fistulae occurred in 39 patients subjected to radiogold, radium and operation, whereas there were no fistulae or other serious urological complications in the 31 patients treated with radiogold and operation, or in the 30 patients treated with only radiogold and radium. (Table VII)

SUMMARY

During the four year period 1950 to 1953, inclusive, 324 patients with cancer of the cervix, League of Nations Stages I, II and III, have been treated by two, quite different methods. One group was treated with X-ray and radium. This group is subdivided into clinic and private patients. In the other group, the parametrium was treated with radiogold, injected transvaginally, and the cervix was treated either by radium or by Wertheim hysterectomy, or by both radium and hysterectomy. In all operated patients a fairly extensive pelvic lymphadenectomy was done at the time of the hysterectomy.

The 2 to 4 1/2 year survival rates of patients with Stage I lesions was 91.4 per cent in the series treated with radiogold, 78.1 per cent in the series of private patients treated with X-ray and radium, and 72 per cent in the clinic patients treated with X-ray and radium. The 1/2 to 4 1/2 year survivals were 92.8 per cent, 80.4 per cent, and 68.8 per cent, respectively. Not many patients with Stage II lesions were treated with radiogold in the first two years of the study. However, eight out of nine patients (88.8%) with Stage II lesions more than two years ago are alive and well. The 1/2 to 4 1/2 year survival rates for patients with Stage II lesions was 89.3 per cent in the series treated with radiogold, 56.5 per cent in the series of private patients treated with X-ray and radium, and 48.1 per cent in the series of clinic patients treated with X-ray and radium.

There were 11 patients among the 70 subjected to radical operation in whom the lymph nodes were positive. Nine of these patients are alive and apparently free of disease. The incidence of positive nodes in Stage I operated cases was 9.8 per cent and in Stage II cases, 31.5 per cent.

In the group of 70 patients subjected to operation, one patient developed a uretero-vaginal fistula, one a uretero-recto-vaginal fistula and one a vesico-vaginal fistula.

The study also has shown that a dosage of 8,000 to 10,000 r is necessary to destroy epidermoid cancer in the cervix itself.

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TABLE I

INTENSITY OF IRRADIATION (rep) CONTRIBUTED FROM BETA SOURCE ALONE IN
VARIOUS PELVIC LYMPH NODES AS BACK CALCULATED TO
10 HOURS FOLLOWING PARAMETRIAL INJECTION

<u>PATIENT</u>	<u>OBTURATOR</u>	<u>HYPOGASTRIC</u>	<u>ILIAC</u>	
			<u>LOWER</u>	<u>UPPER</u>
1	21,000	23,000	12,000	6,200
2	8,400	18,000	13,000	4,400
3	32,000	30,000	12,000	6,500
4	22,000	25,000	15,000	15,000
5	24,500	23,000	7,000	4,000
6	20,000	18,000	6,800	3,500
7	47,000	22,000	13,000	7,000
8	58,000	30,000	12,000	7,300
9	30,000	18,000	15,000	6,800
10	46,000	12,000	8,800	-
11	19,000	15,000	5,700	4,400
12	-	22,000	8,000	6,000
13	30,000	34,000	10,500	6,100
14	63,000	60,000	32,000	-
15	22,000	15,000	14,000	7,000
16	99,000	75,000	8,000	6,300
17	52,000	49,000	22,000	-
18	58,000	42,000	30,000	14,000
19	86,000	78,300	-	14,000
20	33,000	33,000	40,000	-
21	43,000	23,000	13,000	-
22	23,000	36,000	-	16,000
23	29,000	-	13,000	-
24	-	22,000	8,000	6,000

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Alfred I. Sherman, M.D.

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AVERAGE IRRADIATION IN TYPICAL CASE TREATED WITH RADIOGOLD AND RADIUM

	CERVIX	BLADDER	RECTUM	MID PARAMETRIUM
Gamma component (r)				
Radiogold	1,200	1100	1200	2,250
Radium	12,000	6000	5000	3,350
TOTAL	13,200	7100	6200	5,600

Beta component (rep)				
Radiogold	0	0	0	10,600

STAGE I

Years of Treatment	X-RAY CLINIC			AND PRIVATE			Au ¹⁹⁸ + CLINIC AND PRIVATE		
	RADIUM WERTHEIM			RADIUM WERTHEIM			RADIUM WERTHEIM		
	No. Treated	Alive without Disease No.	%	No. Treated	Alive without Disease No.	%	No. Treated	Alive without Disease No.	%
1950	17	12	70.6	8	6	75.0	13	13	100.
1951	8	6	75.0	20	16	80.0	15	12	80.0
1952	4	1	25.0	9	7	77.8	16	15	93.7
1953	3	3	100	14	12	85.7	19	18	94.2
TOTAL	32	22	68.8	51	41	80.4	63	58	92.1
Lost to followup		3			0			1	
Alive with disease		2			1			1	

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STAGE II

Years of Treatment	X-RAY AND RADIUM			Au ¹⁹⁸ + RADIUM			Au ¹⁹⁸ + RADIUM		
	CLINIC			PRIVATE			CLINIC AND PRIVATE		
	No. Treated	Alive without disease No. %	No. Treated	Alive without disease No. %	No. Treated	Alive without disease No. %	No. Treated	Alive without disease No. %	No. Treated
1950	12	6 50.0	11	6 54.5	4	4 100			
1951	19	8 42.1	16	9 56.3	2	2 100			
1952	15	6 40.0	12	7 58.3	11	10 90.9			
1953	8	6 75.0	23	13 56.5	20	17 85.0			
TOTAL	54	26 48.1	62	35 56.5	37	33 89.3			
Lost to followup		5		0		1			
Alive with disease		4		2		2			

STAGE III

Years of Treatment	X-RAY AND RADIUM			Au ¹⁹⁸ + RADIUM			Au ¹⁹⁸ + RADIUM		
	CLINIC			PRIVATE			CLINIC AND PRIVATE		
	No. Treated	Alive without disease No. %	No. Treated	Alive without disease No. %	No. Treated	Alive without disease No. %	No. Treated	Alive without disease No. %	No. Treated
1950	7	2 28.6	7	1 14.3	0	0			
1951	10	2 20.0	2	1 50.0	2	1 50.0			
1952	12	3 25.0	6	1 16.7	2	1 50.0			
1953	11	5 45.5	4	3 75.0	12	9 75.0			
TOTAL	40	12 30.0	19	6 31.6	16	11 68.8			
Lost to followup		3		0		0			
Alive with disease		3		0		0			

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1/2 to 4 1/2 YEAR SURVIVALS

CLINICAL STAGE	X-RAY AND RADIUM						Au ¹⁹⁸ + RADIUM WERTHEIM		
	CLINIC			PRIVATE			CLINIC AND PRIVATE		
	No. Treated	Alive without disease		No. Treated	Alive without disease		No. Treated	Alive without disease	
		No.	%		No.	%		No.	%
I	32	22	68.8	51	41	80.4	63	58	92.8
II	54	26	48.1	62	35	56.5	37	33	89.3
III	40	12	30.0	19	6	31.6	16	11	68.8
TOTAL	126	60	47.6	132	82	62.1	116	102	88.1

2 to 4 1/2 YEAR SURVIVALS

I	25	18	72.0	32	25	78.1	35	32	91.4
II	37	17	46.0	33	18	54.5	9	8	88.8
III	19	5	26.3	14	3	21.4	2	1	50.0
TOTAL	81	43	53.1	79	46	58.2	46	41	89.2

STAGE	METHOD OF TREATMENT	No. TREATED	ALIVE WITHOUT DISEASE		ALIVE WITH DISEASE	SERIOUS GENITO-URINARY COMPLICATIONS
			No.	%	No.	
I	Au ¹⁹⁸ + Surgery	30	27	90.0	0	0
	Au ¹⁹⁸ + Radium and Surgery	21	20	95.2	1	(ureteral vaginal fistula - ileal bladder substitution)
	Au ¹⁹⁸ + Radium alone	12	11	91.7	1	0
II	Au ¹⁹⁸ + Surgery	1	1	100	0	0 (a. Vesico-vaginal fistula. Fistula repaired)
	Au ¹⁹⁸ + Radium and Surgery	18	16	88.8	1	2- (b. Uretero-rectal & vaginal fistula. Ileal bladder substitution and colostomy)
	Au ¹⁹⁸ + Radium alone	18	16	88.8	1	0

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RESULTS IN PATIENTS WITH POSITIVE LYMPH NODES TREATED BY WERTHEIM

AND LYMPHADENECTOMY FOLLOWING INJECTION OF Au¹⁹⁸

STAGE	No. TREATED	INCIDENCE OF POSITIVE NODES		ALIVE WITHOUT DISEASE	
		No.	%	No.	%
I	51	5	9.8	4*	80.0
II	19	6	31.5	5**	83.3

* 1 patient died with generalized carcinomatosis

** 1 patient alive with pulmonary metastases

One additional Stage II patient with a positive iliac node, not treated by surgery, has pulmonary metastases.

PERCENT OF CASES WITH DISAPPEARANCE
OF TUMOR AT THE CERVIX

SQUAMOUS CELL
CARCINOMA

DOSAGE IN ROENTGENS AT 1CM. FROM EXTERNAL OS.

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