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TREATMENT OF TUMOURS OF THE TESTIS

282 TESTICULAR TUMOURS SEEN AT THE LONDON HOSPITAL DURING 1926-61

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Reappraisal of Lymphadenectomy

The late Sir Hugh Cairns reported in 1926 a series of 95 testicular tumours seen at the London Hospital during 1908 to 1925: 55 of these were treated by simple and 19 by radical orchidectomy. After carefully analysing his results Cairns wrote: "I am of the opinion that the results are slightly in favour of the radical operation. Yet it is questionable whether they are a sufficient improvement over the results of orchidectomy to justify the added risk. . . ." As for the use of radiotherapy, then in its infancy, Cairns dismissed it briefly: "In this series treatment of metastases by x rays has been entirely unsuccessful. Some workers have reported good results from the use of radium, but of this I have had no experience."

The next two decades were to see a major change in the approach to treatment. As the techniques of radiotherapy improved so did the results, until by the end of the second world war British surgeons no longer felt that there was any legitimate indication for the radical operation (Gordon-Taylor and Wyndham, 1947).

Since then, for the past fifteen years, simple orchidectomy followed by radiotherapy has been the standard treatment for any testicular tumour, at least in the United Kingdom (Boden and Gibb, 1951; Whittle, 1957; Stephen, 1958; Prossor, 1959; Badenoch and Pugh, 1961).

To-day this position is under attack. In North America, where the radical operation never went completely out of favour, a plausible case has been made out for the surgical removal of abdominal lymph nodes, in addition to radiotherapy, for those types of teratoma

which are regarded as being particularly radio-resistant. At first view the published results of adding lymphadenectomy to a course of radiotherapy appear better than any obtained with radiotherapy alone (Patton, Seitzman, and Zone, 1960).

The operation itself has been improved. New techniques of lymphadenectomy, which go further to satisfy the exacting requirements for complete removal of testicular lymphatics (Jamieson and Dobson, 1910), have now been carried out with an acceptably low mortality (Cooper, Leadbetter, and Chute, 1950; Cahill, 1961; Lewis, 1953; Leadbetter, 1953; Staubitz, Magoss, Oberkircher, Lent, Mitchell, and Murphy, 1958; Dowd, Chute, and Weinert, 1959; Tobenkin, Binkley, and Smith, 1961; Mallis and Patton, 1958).

The present investigation began with the object of finding out whether the omission of lymphadenectomy had resulted in a significantly poorer survival rate for teratomata. Was there a case for changing the present policy of treatment?

No comparative series had ever been treated by radiotherapy with and without lymphadenectomy, so that there existed no clear-cut answer to this question, and without it the same ethical considerations which prevented one surgeon from withholding lymphadenectomy prevented another from performing it.

One commendable attempt to evaluate these alternative methods of treatment was made by Staubitz *et al.* (1958), who compared a series treated during 1922-48 with another series treated in 1949-53. Their study had the merit of dealing with cases seen in a single centre, but the numbers in the second group were small, and the comparison took no account of the advances made in all spheres of treatment, including radiotherapy, over a period of thirty years. Lymphadenectomy had been performed in only 16 patients, and in only six of them were metastases present in the operation specimen—evidence which scarcely justified the conclusion that the slight improvement in the survival rate for teratoma was to be attributed to lymphadenectomy.

The comparison of results from one centre with those from another is open to so many sources of error that authorities have condemned it out of hand when used, for example, in the study of carcinoma of the breast (Atkins, 1960). But in the face of the new claims for lymphadenectomy some attempt must be made to evaluate them, even if not all the evidence is above criticism.

One possible error arises out of the nature of the treatments to be compared. Lymphadenectomy provides the surgeon with histological proof of abdominal metastases. These will be found at operation in approximately one-third of all patients in whom nodes are palpable before operation (Cahill, 1951; Patton *et al.*, 1960). In a proportion of these cases the unsuspected nodes will be fixed and inoperable, a proportion which varies between some 37 and 16% of cases explored (Dowd *et al.*, 1959; Patton *et al.*, 1960). These advanced cases will be excluded from the results of a series treated by lymphadenectomy, but included in a series treated by radiotherapy alone.

A different type of error arises from variations in pathological classification. In the United Kingdom testicular tumours are usually classified into mixed tumours, or teratomata, and seminomata (Cairns, 1926; Gordon-Taylor and Wyndham, 1947; Snelling and

Cones, 1952; Prossor, 1959), and this has been the classification generally used to express the results of radiotherapy.

In the United States the nomenclature of testicular tumours usually follows the system of Friedman and Moore (1946) and Dixon and Moore (1952). This classification, based on very large numbers, is used to express the results of treatment by lymphadenectomy in series such as those reported by Lewis (1953) and by Patton *et al.* (1960).

There are important differences between the two systems. First, the proportion of tumours considered to be seminomata differs very markedly: thus in the series of Patton *et al.* (1960) only 35.4% of testicular tumours are called seminoma, whereas in most British series seminomata amount to some 50 to 60% of the total. As the prognosis of a seminoma is better than that of a teratoma it may be possible that a series treated by radiotherapy might include in its group of seminomata a number of marginal cases which would be called teratomata in North America; while in North America the group of seminomata could include a proportion of cases of lesser malignancy. One would expect the results of radiotherapy to appear rather worse both for seminoma and for teratoma if such series were to be compared.

Again, in Friedman and Moore's classification teratomata are subdivided into four groups: one of these, chorioncarcinoma, is specifically excluded from cases submitted to lymphadenectomy. This small but highly malignant group of tumours, included in a radiotherapy series, should tend to make its results worse.

Clearly it is necessary to compare, so far as is possible, neoplasms that are similar. This was the main object of the present investigation.

At the same time the opportunity was taken to review all cases of testicular tumour seen at the London Hospital since December, 1925, when Cairns terminated his series. The present study thus brings the statistics from the London Hospital up to date in respect of these tumours, and, taken together with Cairns's paper, the present series covers a total number of 377 testicular tumours seen over a period of 54 years—1908 to 1961 inclusive.

Methods of treatment have changed greatly during the 36 years covered by the present series, so that for the purpose of making a comparison between methods of treatment we have limited the consideration of the results of treatment to the cases seen in the 16-year period from January, 1946, to December, 1961, when treatment became more uniform.

Methods and Materials

Records.—From January, 1926, to December, 1945, there were 61 cases of testicular tumour referred to the London Hospital. In eight instances the records were incomplete, and in two the diagnosis was unconfirmed by histological evidence. The remaining 51 cases are available for study. From January, 1946, to December, 1961, 221 cases of testicular tumour were referred: 20 of these have, for various reasons, been excluded from the calculation of the results of orchidectomy and radiotherapy: some patients were referred to the hospital only for follow-up; some were too far advanced for any than palliative treatment; in two instances lymphadenectomy was performed. Two hundred and one cases

treated by simple orchidectomy and radiotherapy are available in this post-war group.

Histology.—All the cases of this series were classified into three groups—seminoma, teratoma, and other tumours—according to the original pathological report. In addition, in 176 cases from the series it was possible to re-examine the original material. An average of three blocks per tumour were examined, new sections cut, and additional stains used as necessary. The intention was that these 176 tumours should be reclassified in terms which would allow a valid comparison to be made with series reported from North America. To do this, constant reference was made to the works of Friedman and Moore (1946) and of Dixon and Moore (1952). A more detailed account of our pathological findings will be published elsewhere (Dayan, Blandy, and Hope-Stone, in preparation).

Treatment.—In the group of 201 cases from 1946 to 1961 suitable for analysis, simple orchidectomy was performed and, when the wound had healed, the patient was referred for radiotherapy. During 1946–50 the majority of patients had only the para-aortic glands irradiated to a tumour-dose level of 3,000 roentgens in four weeks, using conventional deep x rays (200 to 220 kV). In the succeeding and larger group the patients were irradiated either by a trunk bridge technique or by matched parallel and opposed fields, both para-aortic and pelvic nodes being treated with conventional deep x rays (250 kV) to a tumour dose of 2,500 to 3,000 roentgens, given over four weeks. Since 1958 a telecobalt unit has been used to treat all our cases with a pair of parallel and opposed fields, treating pelvic and para-aortic nodes as one entity, to a tumour dose of 3,000 rads in four weeks for seminoma, and 3,500 to 4,000 rads in four weeks for teratoma and embryonal carcinoma. The kidneys were located with intravenous pyelography and shielded by lead blocks.

Follow-up.—In the 1946–61 series the follow-up has been complete except in two cases: one of these two patients emigrated to Canada after seven years, and has not been traced; the other was followed for four years and has not been notified as dead at Somerset House. We have regarded both these untraced patients as dead for the purpose of computing survival rates. Necropsies were obtained in relatively few of the patients dying in this series. In five cases, however, necropsy showed death to be from another cause and no evidence was found of residual tumour. These deaths have not been treated separately. All patients dying in this series are regarded as being dead from tumour for the purpose of computing the survival rates. Our figures present a crude and uncorrected survival rate, and the actual results should be slightly better than those presented here.

Age Incidence

The age incidence of the whole series is depicted in the Chart (see next page).

There is a marked difference between teratoma and seminoma both in the shape of the curves and in the peak of incidence. Not only does seminoma threaten an older group of men, but it continues to levy a toll well on into later life, whereas teratoma is essentially a disease of the young man. The findings of this series are remarkably similar to those presented by Badenoch and Pugh (1961) from the Testicular Tumour Panel and Registry. They differ from the incidence found by Friedman and Moore (1946) in their 922 Service men,

probably because of the selective effect of the age limits of military service. The difference in the age incidence of teratoma is very slight, and would not affect a comparison between two forms of treatment.

It is, however, interesting to note that when Friedman and Moore (1946) corrected their figures for the age

Age incidence of testicular tumours. All cases, 1926 to 1961 inclusive.

composition of the military population at risk they found that the real incidence of seminoma steadily increased with age. We have been unable to correct our own series for the age composition of the population served by the London Hospital, but it may well be that the peak in the incidence of seminoma is illusory.

Results of Histology

In the whole series there were 54.4% seminoma, 42% teratoma, and 3.6% other tumours. Among the other tumours were three lymphosarcomata, two reticulum-cell sarcomata, one leiomyoma, and one leiomyosarcoma of the epididymis—the testis being unaffected, one leiomyosarcoma arising in the tunica vaginalis, and one fibrosarcoma arising in the spermatic cord without involving the testis.

In the series of 201 patients treated by orchidectomy and radiotherapy since 1946 there were 54.7% seminoma, 42.8% teratoma, and 2.5% other tumours.

The incidence of the various types in the 176 cases which we have classified according to the criteria of Dixon and Moore (1952) is shown in Table I and compared with the incidence of these types reported by Patton *et al.* (1960).

TABLE I.—Frequency of Types of Testicular Tumours Classified According to Dixon and Moore (1952)

Type of Tumour	Present Series (176 Cases)	Patton <i>et al.</i> (1960) (389 Cases)
Seminoma	60.4%	35.4%
Embryonal carcinoma	6.3%	32.2%
Teratoma	6.3%	2.05%
Teratocarcinoma	24.3%	26.5%
Choriocarcinoma	2.5%	2.05%
Others	0	1.8%

Results of Simple Orchidectomy and Radiotherapy

The crude survival rates obtained in the cases seen during 1946–61 are set out in Tables II and III.

TABLE II.—Results of Treatment in Seminoma. Simple Orchidectomy and Radiotherapy (1946–61)

Years	Without Metastases			With Metastases		
	Available	Survived	C.S.R. %	Available	Survived	C.S.R. %
15	5	2	40.0	0	0	0
14	11	4	36.4	3	0	0
13	19	6	40.0	4	0	0
12	19	10	52.5	6	1	16.7
11	21	11	52.5	8	1	12.5
10	29	15	51.7	10	1	10.0
9	33	18	53.1	12	3	25.0
8	37	23	62.0	16	4	25.0
7	48	33	68.5	16	5	31.2
6	51	38	74.5	17	7	41.2
5	56	43	76.7	19	7	35.8
4	58	47	81.0	20	8	40.0
3	62	51	82.3	21	8	38.2
2	68	55	82.3	25	8	32.0
1	79	75	95.0	25	12	48.0

C.S.R. = Crude survival rate.

TABLE III.—Results of Treatment in Teratoma. Simple Orchidectomy and Radiotherapy (1946–61)

Years	Without Metastases			With Metastases		
	Available	Survived	C.S.R. %	Available	Survived	C.S.R. %
10	34	12	35.3	4	0	0
9	36	12	33.3	5	0	0
8	44	16	36.3	6	0	0
7	50	19	38.0	6	0	0
6	51	19	37.3	7	0	0
5	51	20	39.3	9	0	0
4	53	20	37.7	11	1	9.1
3	56	24	42.9	13	1	7.7
2	63	30	47.6	13	1	7.7
1	68	44	64.7	14	4	28.6

If these results are compared with those from other radiotherapeutic centres in the United Kingdom there is seen to be close agreement (Boden and Gibb, 1951; Snelling and Cones, 1952; Whittle, 1957; Stephen, 1958; Prosser, 1959).

In the present series, however, when the annual survival rates are considered, it is found that there is a steady decline in the survival rate for seminoma, which continues until ten years from the initial treatment. For teratoma there is a steep fall over the first three years, but afterwards a rather steady survival rate.

This finding is in conflict with the view, which has often been expressed, that the mortality for testicular tumours is negligible after the third year. The present findings may be due to the fact that in the years 1946–50 in the majority of the cases only the para-aortic nodes were irradiated; however, it does suggest that three- and five-year statistics may not be adequate, and that the follow-up period for this neoplasm should be as prolonged as for cancer in other sites. The differences in the survival rates recall the differences obtained in the most benign and the most anaplastic tumours of the breast (Bloom and Richardson, 1957).

In the 1946–61 group of cases available for five years there were 71 cases in which the original pathological material could be reassessed according to the categories of Dixon and Moore (1952). The results according to each of these groups are set out in Table IV. The significance of these results is discussed below: the main point is the 68.7% five-year survival rate obtained with teratocarcinoma by simple orchidectomy and radiotherapy.

TABLE IV.—Five-year Results in 71 Cases Treated by Simple Orchidectomy and Radiotherapy, Classified According to Dixon and Moore (1952)

Tumour Type	Without Metastases			With Metastases		
	Available 5 Years	Survived 5 Years	C.S.R. %	Available 5 Years	Survived 5 Years	C.S.R. %
Seminoma	38	33	87	7	3	43
Embryonal carcinoma	1	0		1	0	
Teratoma	1	1		1	0	
Teratocarcinoma	16	11	68.7	3	0	0
Choriocarcinoma	3	0		0		

Clinical Features of Testicular Tumours

Side of Tumour.—Of all the unilateral tumours in this series 46% were on the left side and 54% on the right. Bilateral tumours were seen in four additional cases, an incidence of 1.4% in the entire series.

Methods of Presentation

In the present series 82% of patients came with a swelling in the scrotum. Of this group 15% complained of pain as well, and 6.4% attributed either pain or swelling or both to recent injury. In the whole series only three cases were discovered as incidental findings: one patient was found to have a swelling in the testis when in hospital for haematemesis, and in two cases small tumours were found in testes removed in the course of a herniorrhaphy. Metastases presenting before the primary tumour were seen in seven cases.

We have not tabulated the errors in diagnosis made before orchidectomy. Some were responsible for undue delay in treatment; among these cases were five diagnosed as epididymo-orchitis.

The classical presentation of testicular tumour as varicocele occurred in two instances, and another patient presented with a thrombosis of the pampiniform plexus.

Three patients had hydrocele as their first physical sign: one underwent a radical cure for his hydrocele elsewhere four months before malignancy was diagnosed. Although small secondary hydroceles were often present in the specimen, this series confirms the usual impression that hydrocele is a rather rare presentation for a testicular neoplasm.

Swelling and pain in the nipples were the first symptoms of two patients: one had a seminoma and his Aschheim-Zondek test was positive. The other had a teratoma and a negative Aschheim-Zondek.

One patient, a doctor, sought advice because of infertility seven years before a testicular seminoma was diagnosed. A second patient had haematospermia for two years before a seminoma was removed.

Imperfect Descent of Testis

In 17 patients the tumour arose in an imperfectly descended testicle (6.1%). This is similar to the 5% reported by Badenoch and Pugh (1961), 7% by Whittle (1957), and 4.7% by Patton, Hewitt, and Mallis (1959). Campbell (1959) has reviewed the whole question of the significance of the increased incidence of tumour in undescended testes, and has pointed out that successful orchidopexy is no guarantee against subsequent development of neoplasm. In this series four patients had previously undergone orchidopexy.

It would seem that the error of growth which produces a neoplasm has less to do with the site of the testis than

with some more general factor: two cases in this series (L.H. Nos. 2547.31 and 37469.51) had undescended testicles on one side, but the neoplasm developed in the other, normally situated testis. Similar cases have been described by Cairns (1926) and by Whittle (1957). A third case in this series (L.H. No. 1136) had bilateral undescended testicles, one of which became malignant.

Ten of the 17 tumours developing in undescended testicles were seminomata: seven were teratomata, a proportion which is similar to that found by Dixon and Moore (1952).

In three cases torsion was the first suggestion that the undescended testicle had undergone malignant change.

There were five seminomata originating in undescended testicles in the post-war group followed for more than five years, and three survived. Not one of four cases of teratoma arising in undescended testes survived five years. These small numbers suggest that perhaps the prognosis may be worse if the tumour arises in an undescended testicle.

Discussion

Case for Lymphadenectomy

Thanks to the courtesy of Colonel John F. Patton, we have been able to compare crude survival rates in his series with our own. This is necessary because our follow-up is only 99% complete, and we do not have complete necropsy information. We have compared crude survival rates at five years for teratocarcinomata, the only group of cases reclassified according to Dixon and Moore (1952) where numbers are adequate (Table IV).

It will be seen from Table V that the five-year crude survival rate in the present series compares not unfavourably with that of Patton (1962), although the difference is not statistically significant ($P=0.45$).

TABLE V.—Comparison of Results of Simple Orchidectomy and Radiotherapy with Simple Orchidectomy Followed by Lymphadenectomy and Radiotherapy (Patton *et al.*, 1960; Patton, 1962), in Teratocarcinomata (Group IV, Dixon and Moore, 1952). Five-year Results

	Available	Survived	C.S.R.
Present series	16	11	68.7%
Patton (1962) (all cases completed operation)	66	36	54.5%

$P=0.45$.

We have compared our results in cases without clinical evidence of metastases with Patton's patients who successfully underwent lymphadenectomy, because in none of these were nodes felt before operation (Patton, 1962). However, some 16% (48 in 291) of cases without palpable nodes were excluded from the series because they were found to have inoperable metastases at the time of operation (Patton *et al.*, 1960). A series treated by radiotherapy alone will probably include a similar proportion of very advanced tumours.

In the present series, seminoma was more common, and embryonal carcinoma was found less often than in Patton's cases (Table I). Some of the excess is probably due to the greater proportion of older patients in the present series. There may also be a difference in the geographical incidence of these tumours. In independent British and Norwegian series, both civilian (Gordon-Taylor and Wyndham, 1947; Høst and Stokke,

1959; Prossor, 1959) and military (Stephen, 1958), the incidence of seminoma is similar to that found here. It is also possible that some of the tumours we have called "seminomata" would have been listed as "embryonal carcinomata" in the series reported by Patton *et al.* (1960). This would have the effect of excluding a substantial proportion of less malignant tumours from the present series.

For these two reasons we believe that the comparison set out in Table V is heavily weighted in favour of lymphadenectomy.

That the results of radiotherapy are not only not significantly worse but may even be a little better than when lymphadenectomy is added is surprising and remarkable. It prompts a more critical appraisal of the theoretical basis on which lymphadenectomy has been advocated.

Radioresistance of Teratomata

The experimental studies on which is based the concept of the radioresistance of some teratomata have not been published in full. They are referred to by Friedman (1944) and Lewis (1948) as evidence for the idea that nothing short of a radiation dose of some 5,000 roentgens would suffice to sterilize abdominal metastases. Irradiation at this dose level was unsatisfactory; Lewis (1948) refers to 14 such patients with intestinal perforations, of whom eight died, and to three others with paraplegia.

Because irradiation at this dosage was dangerous Lewis turned to surgical removal of the lymph nodes instead of, or as a supplement to, a smaller dose of radiation.

We question the basis of this argument. The measurement of the sterilizing dose of irradiation for a given histological type of tumour is not easy, and without the protocol of Friedman's studies one cannot tell whether they were as conclusive as the inferences drawn from them would imply. There is suggestive evidence to the contrary. For example, no viable tumour was demonstrated at necropsy in any of Lewis's eight patients given 5,000 roentgens who died with intestinal perforations. Can we be sure that a smaller dose than 5,000 roentgens might not have been equally as effective? Leadbetter (1953) cites a suggestive case: 2,000 roentgens had been given to the retroperitoneal nodes which were clinically enlarged in a case of embryonal-cell carcinoma. No tumour tissue was found at subsequent dissection of the retroperitoneal tissue. Again, in the present series one patient (L.H. No. 29306.57) had an orchidectomy for group IV teratocarcinoma of testis with embryonal-cell carcinoma elements. There was a large abdominal mass. He is still alive five years after a course of radiotherapy to a tumour dose of 3,000 roentgens.

From isolated cases such as these it is clear that not all embryonal-cell carcinomata or teratocarcinomata are completely radioresistant. McDonald (1948) commented that in his experience, as in that of Lowry, Beard, Hewitt, and Barner (1946), the results were better with radiotherapy and simple orchidectomy than in Lewis's series treated by lymphadenectomy.

It is true that without radiotherapy Leadbetter (1953) and Patton *et al.* (1960) have had prolonged survivors from whom positive nodes were removed by dissection. Nor will there be any question that surgical removal of these nodes can be followed by cure. The point at issue is whether surgery is the instrument of choice, particu-

larly when, as a general rule, lymphadenectomy has been supplemented by radiotherapy to a substantial dose.

The confusion is not less confounded by the continual improvement in surgical technique. The limitation of unilateral retroperitoneal node dissection, the old operation associated with the names of Russell Howard (1907) and Hinman (1935), was that testicular tumours might be widely disseminated to both groups of para-aortic nodes on each side of the midline (Jamieson and Dobson, 1910). Leadbetter (1953), using a thoraco-abdominal approach to bilateral lymphadenectomy, found that 5 out of 19 operable cases had contralateral involvement (26.3%), an incidence which increased in terminal cases coming to necropsy to a figure as high as 35.3% (Lowry *et al.*, 1946). It is true that in recent years more thorough retroperitoneal dissection has come into practice, but one may still entertain a doubt whether even now these newer procedures (Mallis and Patton, 1958; Dowd *et al.*, 1959; Tobenkin *et al.*, 1961) really "... strip the aorta and vena cava, the common iliac vessels, the proximal third or so of the internal iliac vessels, the upper part of the spermatic vessels on either side, and the trunk of the inferior mesenteric artery, of all the cellulo-fatty tissue lying on, around, and between them from the level of the renal vessels downwards" (Jamieson and Dobson, 1910). It may be possible to perform such a dissection. It would be a difficult operation. One may legitimately inquire how often such an exploration is likely to do good.

If we may consider only the statistics from the Walter Reed Army Hospital (Patton *et al.*, 1960), we find that out of a total of 291 patients who underwent operation 48 had inoperable conditions. Of the 243 patients in whom the operation was completed, no histological metastases were demonstrated in 192 specimens.

It may be unfair to conclude that 240 (48+192) patients underwent an unnecessary laparotomy; nevertheless it is permissible to ask whether the same ends might not have been served more simply, and perhaps with less morbidity, by radiotherapy in the 51 patients who alone had positive nodes removed.

Some of the unprofitable operations might be avoided if inoperability could be diagnosed without opening the abdomen. Dowd *et al.* (1959) recommended digital exploration through the internal ring at the time of orchidectomy to exclude cases with fixed abdominal masses from further surgery. But in their own series of 26 lymphadenectomies there were seven patients who were found to be inoperable and eight with negative nodes. Evidently even this precaution is not completely reliable.

One thing is quite clear, if lymphadenectomy is to be used in routine treatment of all teratomata other than chorioncarcinoma, then many unnecessary exploratory operations will have to be performed and many negative nodes removed. Provided that the mortality of these operations can be kept to the zero reported by Patton *et al.* (1959, 1960) perhaps these procedures can be justified. It may, however, be of significance that no mention is made of the morbidity following these operations, which, at first view, one might expect to be not inconsiderable.

Improvements in Radiotherapy

If the operative removal of lymph nodes is a steadily improving technique, so also is their sterilization by radiotherapy. In the present series an improvement in

crude survival rates can be seen even when comparing the first with the second five-year period (Table VI).

TABLE VI.—*Progress in Radiotherapy. Five-year Crude Survival Rates. All Tumours. Simple Orchidectomy and Radiotherapy*

Series	Five-year Crude Survival Rate
1946 to 1950 inclusive	43%
1951 " 1956 "	63%

We believe that this improvement is in part due to the change in technique from irradiation of only the para-aortic nodes with a tumour dose of 3,000 roentgens in four weeks and deep x rays 200 to 220 kV to the use of a trunk-bridge technique or matched parallel and opposed fields, with a tumour dose of 2,500 to 3,000 roentgens in four weeks and deep x rays (250 kV).

A further technical improvement took place in 1958 with the introduction of the telecobalt unit. It is too early to say whether this latest change in method has influenced our survival statistics, but this technique of radiotherapy is easier than with conventional (250 kV) radiotherapy, and patients tolerate the treatment much better. There certainly is some morbidity associated with any form of radiotherapy. In our series this has seldom been more severe than transient nausea, leucopenia, and minor skin reactions. We have never seen the intestinal perforation and paraplegia encountered in Lewis's (1948) series.

Radiation nephritis was seen in one patient treated in 1948 (L.H. No. 4285.48) who died with malignant hypertension (Wilson, Ledingham, and Cohen, 1958).

One patient developed persistent lymphoedema of the lower limb after irradiation which included the groin as well as the pelvis on the side of his teratoma, but he is alive and otherwise well ten years after treatment.

Infertility might be expected after irradiation. Care is taken as a routine to protect the opposite testis during treatment. In at least one case this appears to have been of value. This patient (L.H. No. 10617.51) has sired three children since receiving 3,000 roentgens after orchidectomy for teratoma without obvious clinical metastases (group IV teratocarcinoma) more than ten years ago. He is still well.

Conclusions

In this comparison between the results of radiotherapy with and without lymphadenectomy the sources of error should have weighed against the series treated only by radiotherapy. In spite of this it appears that radiotherapy, without disturbing the retroperitoneal tissues by operation, gives slightly better results than those obtained by adding lymphadenectomy. The theoretical basis for the notion that certain teratomata are radio-resistant appears to be open to criticism: at least the group IV teratocarcinomata are fairly radiosensitive.

From this investigation we feel that the evidence as it stands to-day does not require us to change our policy of treatment and that the proper treatment for all varieties of testicular neoplasm is orchidectomy, supplemented by radiotherapy, without surgical removal of the abdominal lymph nodes.

Summary

The 282 testicular tumours seen at the London Hospital during 1926–61 inclusive are reviewed. Of these cases 201 were treated by simple orchidectomy and radiotherapy in 1946–61. The histological diagnosis was reviewed, and reclassified according to the system used by the U.S.A.F. Institute of Pathology, in 176 cases.

The results of radiotherapy after simple orchidectomy are compared with published results for lymphadenectomy combined with radiotherapy after simple orchidectomy. The crude five-year survival rate for comparable groups of teratocarcinoma is no worse when lymphadenectomy is omitted from the treatment.

Pathological and clinical features of the entire series are reviewed.

It is suggested that there is no indication for performing lymphadenectomy when there are adequate facilities for radiotherapy.

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In a report issued by the Council of Europe's Council for Cultural Co-operation a committee investigating the taking of drugs in sport has urged that Olympic Games competitors should take an additional oath promising that they will not use drugs to improve their performance. (*Daily Telegraph*, February 27.)