Thirty-five patients with a diagnosis of pure ovarian dysgerminoma underwent assessment at our institution between 1950 and 1984. The median age of these patients was 21 years (range, 8 to 41 years). The surgical pathologic stages of the tumors were as follows: stage IA1 in 18 patients, stage IA2 in 2, stage IB1 in 2, stage IC in 1, stage IIB in 2, stage III in 9, and stage IV in 1. The overall survival at 5, 10, and 20 years was 94.3%, 82.9%, and 82.9%, respectively, for all 35 patients and 100%, 83.9%, and 83.9%, respectively, for the 18 patients with stage IA1 lesions. The maximum interval from diagnosis to relapse was 3.7 years. All patients were under surveillance for a minimum of 2 years (median follow-up, 15.9 years). Of the 18 patients with stage IA1 disease, 16 did not receive prophylactic radiation therapy to the para-aortic lymph nodes, and in 6 of the 16 (38%) recurrent disease developed in this region. Five of these patients were salvaged with radiation therapy and one with radiation therapy and subsequent chemotherapy. No definite correlation was noted between the size or mass of the resected unilateral encapsulated tumor and the risk of development of recurrent disease. For patients with stage IA1 dysgerminoma who have undergone unilateral oophorectomy, two treatment options seem reasonable: (1) observation, with radiation therapy reserved for subsequent recurrence, or (2) prophylactic radiation therapy (2,000 cGy) to para-aortic and ipsilateral common iliac lymph nodes, which would preserve fertility.
sites of treatment failure, and radiosensitivity. Our objective was to accumulate information that would assist in the development of rational treatment decisions for maximizing curability and minimizing treatment-related morbidity and loss of fertility in this young patient population.

PATIENTS AND METHODS
During the period 1950 through 1984, 39 patients with a diagnosis of ovarian dysgerminoma were treated at our institution. In four patients, other germ cell or carcinomatous elements were present in the histologic specimen. Therefore, these patients were excluded from analysis, and this study is based on the remaining 35 patients with a diagnosis of pure dysgerminoma.

Clinical Features.—The median age of the 35 patients was 21 years (age range, 8 to 41 years). In the study group, 15 patients (43%) were age 20 years or younger and 30 (86%) were age 30 years or younger. Of the 35 patients, 25 were nulliparous at the time of diagnosis, including 2 who were prepubertal. The gravidity and parity of the other 10 patients ranged from one to five. The tumor was detected during pregnancy in four patients. None of the patients had gonadal dysgenesis. Two patients were nontwin sisters, ages 15 and 18 years at the time of diagnosis.

The symptoms at the time of diagnosis were abdominal pain in 14 patients, an abdominal mass in 13, menstrual irregularities in 11, general malaise in 8, nausea in 6, vomiting in 5, vaginal bleeding in 2, breast tenderness in 1, and excessive abdominal enlargement during pregnancy in 1. Physical findings at the time of diagnosis included a pelvic mass in 26 patients, a palpable abdominal mass in 20, an enlarged supraclavicular lymph node in 1, and hirsutism in 1.

Investigations.—Studies for serum tumor markers including lactate dehydrogenase, $\beta$ subunit of human chorionic gonadotropin, and $\alpha$-fetoprotein were done infrequently but when performed showed no elevated values. All 35 patients had normal findings on a chest roentgenogram at the time of diagnosis. Intravenous pyelography was interpreted to show abnormal findings in all eight patients in whom this study was performed, as did ultrasonography of the pelvis in all three patients who underwent that study. Lymphangiography revealed abnormal findings in one of the two patients in whom it was performed, and computed tomography of the abdomen and pelvis disclosed abnormal findings in the one patient examined with this modality.

Staging of Lesions.—The distribution of the surgical pathologic stages of the lesions, based on the International Federation of Gynecology and Obstetrics (FIGO) classification, in these patients was as follows: stage IA1 in 18 patients, stage IA2 in 2, stage IB1 in 2, stage IC in 1, stage IIB in 2, stage III in 9, and stage IV in 1.

Surgical Treatment.—The surgical procedures performed were unilateral salpingo-oophorectomy in 24 patients, bilateral salpingo-oophorectomy in 11, hysterectomy in 10, pelvic lymphadenectomy in 9, para-aortic lymphadenectomy in 8, and omentectomy in 5. Eight patients underwent initial surgical treatment at our medical center; an additional five patients had a completion surgical procedure at our institution, and three had a second-look laparotomy.

Operative procedures in the 18 patients with stage IA1 disease included unilateral salpingo-oophorectomy in 16 patients, para-aortic lymphadenectomy in 5, multiple staging biopsies in 4, biopsy of the contralateral ovary in 4, hysterectomy in 2, omentectomy in 2, bilateral salpingo-oophorectomy in 2, and pelvic lymphadenectomy in 1. Of these 18 patients with stage IA1 lesions, 6 underwent initial surgical exploration at our institution; 2 patients had a completion surgical procedure at our clinic, and three had a second-look laparotomy.

Pathologic Findings.—All 35 patients had pure dysgerminoma. The median diameter of the tumors removed was 15 cm (range, 8 to 27 cm). The tumor originated in the right ovary in 18 patients, the left ovary in 13, and bilaterally in 4. Twenty-five tumors were encapsulated, 14 had a lobular configuration, and 12 had visible hemorrhage or necrosis.

Adjuvant and Salvage Therapy.—Of the 35 patients, 20 (57%) received radiation therapy after initial surgical treatment, and 8 patients received irradiation as salvage therapy after recurrent disease was diagnosed. One patient received one cycle of combination chemotherapy before receiving whole-abdomen radiation therapy. Another patient received combination chemotherapy after recurrence of the tumor in the left supraclavicular lymph node region.

Of the 18 patients with stage IA1 lesions, 4 received postoperative radiation therapy, and 6
received radiation therapy after recurrent disease was diagnosed.

**Statistical Analysis.**—Both survival until death and relapse-free survival were analyzed by use of the Kaplan-Meier method, which appropriately uses information from observations with incomplete follow-up (censored). For purposes of relapse-free survival, a patient whose death was unrelated to the dysgerminoma was defined as lost to follow-up at the time of death. Survival of patients with stage IA1 disease was compared with survival of patients with all other stages of lesions by the log-rank test for censored data. Because of small sample sizes, lack of statistical significance should not be interpreted as no evidence of a difference between groups. The association between diameter and mass of the tumor and relapse-free survival was assessed with the logit-rank procedure.

**RESULTS**

**Relapse-Free Survival.**—Among patients with stage IA1 tumors, relapse-free survival at 1 year, 2 years, and 4 years was 100%, 88.9%, and 62.2%, respectively (Fig. 1). The relapse-free survival of all patients except those with stage IA1 disease was 88.6% at 1 year after diagnosis of the dysgerminoma, 82.9% at 2 years, and 67.4% at 4 years. The earliest relapse was 4½ months after diagnosis, and the latest observed relapse was at 3.7 years. Of the 18 patients with stage IA1 lesions, 3 have not yet been under surveillance for a minimum of 4 years.

**Overall Survival.**—The overall survival at 5, 10, and 20 years after the date of diagnosis of dysgerminoma was 94.3%, 82.9%, and 82.9%, respectively, for all 35 patients and 100%, 83.9%, and 83.9%, respectively, for the 18 patients with stage IA1 disease (Fig. 2). The median follow-up was 15.9 years, and all patients were under surveillance for a minimum of 2 years.

Of the 35 patients, 6 have died, and two of the six deaths were attributable to the dysgerminoma (one patient had stage III and the other had stage IV disease; both were diagnosed and treated in the early 1950s). One patient with stage III disease died of a malignant fibrous histiocytoma originating in the left buttock at age 22 years (8 years after diagnosis, with no evidence of dysgerminoma). Another patient with stage IA2 disease died of natural causes at age 66 years, 30 years after diagnosis, with no evidence of disease. Two patients with stage IA1 lesions died of radiation complications (pulmonary fibrosis and nephritis) with no evidence of disease. These patients received radiation therapy at the time of recurrence of disease (in 1959 and 1967). One patient with stage IA disease was lost to follow-up 3 years after the initial diagnosis, at which time she was without evidence of disease.

**Fertility After Treatment.**—Nine of the 18 patients with stage IA1 lesions had fertility-preserving operations, no contralateral ovarian irradiation, and a minimum of 8 years of follow-up. Five of these nine patients (56%) eventually conceived and had children.

**ANALYSIS OF TREATMENT FAILURES**

**Stage IA1.**—Of the 18 patients with stage IA1 dysgerminoma, 14 did not receive postoperative radiation therapy. Recurrent disease developed in five of these patients. Four of the 18 patients with stage IA1 disease did receive prophylactic postoperative irradiation. The anatomic areas treated included the pelvis in all four patients and the para-aortic lymph nodes in two patients. In one of the two patients who received postoperative pelvic irradiation alone, recurrent disease developed in the para-aortic lymph nodes. Therefore, a total of 6 of the 16 patients (38%) with stage IA1 lesions died of recurrent disease.
IA1 lesions who did not receive prophylactic treatment to the para-aortic lymph nodes subsequently had recurrence of disease.

The anatomic sites of initial treatment failure are shown in Table 1. None of the patients with unilateral encapsulated tumors had recurrence of disease in the peritoneal cavity. Five of the six patients with stage IA1 lesions in whom recurrent disease developed were salvaged with radiation therapy. The other patient received whole-abdomen irradiation at the time of diagnosis of recurrence in the para-aortic and ipsilateral common iliac lymph nodes. After radiation therapy, the tumor size diminished by more than 90%. Five months later, recurrent disease developed in the left supraclavicular lymph node region. The patient then received four cycles of chemotherapy consisting of cisplatin, vinblastine sulfate, and bleomycin. After chemotherapy, the residual para-aortic mass was somewhat smaller on a computed tomographic scan. Therefore, an exploratory laparotomy was performed, which revealed necrotic tissue but no tumor. The patient has remained free of disease without further treatment.

Stage IA2.—One of the two patients with stage IA2 dysgerminoma underwent a total abdominal hysterectomy and bilateral salpingo-oophorectomy and then received postoperative radiation therapy to the pelvis and para-aortic lymph nodes. She has remained without evidence of disease. The second patient underwent a right salpingo-oophorectomy but did not receive postoperative radiation therapy. Recurrent disease developed 2 years later in both pelvic sidewalls (peritoneal failure), bilateral iliac lymph nodes, and para-aortic lymph nodes. The patient was salvaged with radiation therapy.

Stage IB1.—Both patients with stage IB1 tumors underwent bilateral salpingo-oophorectomy. In addition, a hysterectomy was performed in one of the two patients. One patient received postoperative radiation therapy to the pelvis and para-aortic lymph nodes, and the other patient received radiation therapy to the pelvis alone. Both patients have remained without evidence of disease.

Stage IC.—The one patient with stage IC dysgerminoma underwent a unilateral salpingo-oophorectomy. Postoperatively, she received one cycle of vincristine, cyclophosphamide, and actinomycin D. She then returned home and received whole-abdomen radiation therapy with a boost to the para-aortic lymph nodes and has remained without evidence of disease.

Stage IIB.—One of the two patients with stage IIB tumors underwent total abdominal hysterectomy and bilateral salpingo-oophorectomy. A unilateral salpingo-oophorectomy was performed in the second patient. Both patients received postoperative whole-abdomen radiation therapy. One patient is alive without evidence of disease. In the second patient, a malignant fibrous histiocytoma of the left buttock developed 5 years after diagnosis, and she died of that disease 3 years later. We could not accurately assess whether this second malignant lesion arose within the previous radiation field.

Stage III.—Of the nine patients with stage III dysgerminoma, five had encapsulated tumors with grossly involved para-aortic lymph nodes.

Table 1.—Anatomic Sites of Initial Treatment Failure in 18 Patients With Stage IA1 Dysgerminoma

<table>
<thead>
<tr>
<th>Site</th>
<th>Patients</th>
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<tbody>
<tr>
<td>Para-aortic lymph nodes</td>
<td>6 33</td>
</tr>
<tr>
<td>Mediastinum</td>
<td>2 11</td>
</tr>
<tr>
<td>Left supraclavicular fossa</td>
<td>2 11</td>
</tr>
<tr>
<td>Ipsilateral common iliac lymph nodes</td>
<td>2 11</td>
</tr>
<tr>
<td>Lungs</td>
<td>1 6</td>
</tr>
<tr>
<td>Peritoneum</td>
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Fig. 2. Overall survival among 35 patients after diagnosis of ovarian dysgerminoma. *Lighter curve* = survival among 18 patients with stage IA1 lesions; *boldface curve* = survival among 17 patients with all other stages of lesions (stages IA2 through IV).
Two patients received whole-abdomen irradiation, two patients were treated postoperatively with irradiation to the pelvis and para-aortic lymph nodes, and one patient received radiation treatment to the pelvis and para-aortic lymph nodes followed by prophylactic irradiation of the mediastinum. In two of the five patients, recurrent disease developed. In one patient, the tumor recurred in the left supraclavicular lymph node region after irradiation had been administered to the pelvis and para-aortic lymph nodes. This patient was salvaged with mediastinal and supraclavicular irradiation. In the second patient, recurrence of disease developed in the previously irradiated para-aortic lymph nodes (she had received a dose of 2,000 cGy in 1953). No further treatment was given, and the patient died of the disease.

The other four patients with stage III disease had nonencapsulated primary tumors. Two patients received postoperative whole-abdomen irradiation. One patient received treatment to the pelvis and para-aortic lymph nodes, and the remaining patient received treatment to the pelvis and para-aortic lymph nodes followed by prophylactic mediastinal irradiation. All four patients have remained without evidence of disease.

Stage IV.—The initial manifestation in the patient with stage IV dysgerminoma was an enlarged right supraclavicular lymph node. An excisional biopsy was performed followed by an abdominal exploration. Both ovaries were involved, as were the left iliac and para-aortic lymph nodes. The patient received postoperative irradiation to the pelvis, para-aortic lymph nodes, mediastinum, and right supraclavicular lymph node. Recurrent disease developed in multiple osseous sites. She received palliative irradiation and died of the disease.

Unilateral Encapsulated Tumors.—The size in centimeters and the mass in grams of the unilateral encapsulated tumors of the (1) patients with stage IA1 lesions who received no postoperative radiation therapy and had no relapse (N = 9), (2) the patients with stage IA1 lesions who received no postoperative radiation therapy and subsequently had recurrent disease (N = 5), and (3) the patients with stage III lesions who had encapsulated tumors and positive para-aortic lymph nodes at the time of diagnosis (N = 5) are displayed in Figures 3 and 4. The tumor mass was not always recorded in the pathology record. No definite association was noted between the size or mass of the resected unilateral encapsulated ovarian tumor. NED = no evidence of disease. Open circles = no para-aortic lymph node involvement; closed circles = para-aortic lymph nodes involved with tumor.

Fig. 3. Correlation between para-aortic lymph node involvement in patients with ovarian dysgerminoma and diameter of resected encapsulated ovarian tumor. NED = no evidence of disease.

Treatment to Peritoneal Cavity.—Treatment failure did not occur in the peritoneal cavity in the 25 patients with an encapsulated tumor or in the 5 patients with nonencapsulated tumors who received whole-abdomen irradiation. Of four patients with a nonencapsulated tumor who received less than whole-abdomen irradiation, one had treatment failure in the peritoneal cavity.

Treatment of Involved Para-aortic Lymph Nodes.—Thirteen patients received radiation therapy for gross involvement of the para-aortic lymph nodes with tumor. Of the 13 patients, 7 had stage III lesions and involvement of para-aortic lymph nodes at the time of initial treatment, and the other 6 patients received radiation therapy for recurrent disease in the para-aortic lymph nodes.

Five of the 13 patients received radiation therapy to the gross para-aortic disease followed by prophylactic radiation therapy to the mediastinum and supraclavicular lymph node regions. None of these five patients experienced tumor recurrence. The other eight patients received...
Fig. 4. Correlation between para-aortic lymph node involvement in patients with ovarian dysgerminoma and mass of resected encapsulated ovarian tumor. NED = no evidence of disease. Open circles = no para-aortic lymph node involvement; closed circles = para-aortic lymph nodes involved with tumor.

radiation therapy to the gross para-aortic disease alone. In four of these eight patients, recurrent disease developed in the mediastinum or supraclavicular lymph node regions. Three of these four patients were salvaged with additional radiation therapy, and one was salvaged with combination chemotherapy.

DOSE RESPONSE
Forty-one areas were treated prophylactically with radiation doses that ranged from 1,000 to 3,650 cGy (median, 2,500 cGy). No recurrent disease developed within these prophylactically treated areas.

Twenty-one areas of gross disease were treated with radiation doses that ranged from 1,300 to 4,800 cGy (median, 3,100 cGy). Only one definite in-field treatment failure occurred—in a patient who had received approximately 2,000 cGy with orthovoltage equipment in 1953. In another patient, a greater than 90% reduction in tumor size occurred after irradiation. In this patient, a computed tomographic scan of the abdomen still showed abnormal findings at the time of recurrence in the supraclavicular region. Therefore, the patient was treated with four cycles of cisplatin, vinblastine sulfate, and bleomycin, after which the lesion was slightly smaller yet persistent on a computed tomographic scan. An exploratory laparotomy revealed necrotic tissue and no tumor.

COMPLICATIONS
Major complications from radiation therapy developed in two patients. One patient had received 2,875 cGy to both lungs in 1959 as salvage therapy for metastatic lesions. The patient died 3 years later without evidence of disease and with autopsy proof of pulmonary fibrosis. The second patient had received 2,100 cGy to the whole abdomen in 1967 for a diagnosis of recurrent para-aortic lymph node disease. This patient died with a clinical diagnosis of radiation-induced nephritis and no evidence of disease. An autopsy was not performed.

DISCUSSION
The clinical features of this group of patients with dysgerminoma, including the age at the time of diagnosis, initial symptoms, initial findings on physical examination, and location, size, mass, and bilaterality of the tumors, were consistent with the clinical features previously described in the literature.1-4,7,11-13

In the current series, the finding of two non-twin siblings, ages 15 and 18 years at the time of diagnosis, was unusual. A family history of ovarian dysgerminoma has rarely been reported previously.4,14

The overall survival at 5, 10, and 20 years of 94.3%, 82.9%, and 82.9%, respectively, compares well with recently reported survival rates of 82.6 to 91.7% at 5 years and 83.5% at 10 years in other studies.2,3,7,11,12

In the current series of patients, the time from diagnosis to relapse ranged from 4½ months to 3.7 years. Previously reported times from diagnosis to relapse have ranged from 3 months to 6 years, and 96% of recurrences have been noted within 5 years after diagnosis.2,11 Therefore, follow-up examinations should be performed regularly for a minimum of 5 years after diagnosis.

The frequency of recurrence of disease after unilateral oophorectomy alone for stage IA1 dysgerminoma was 5 of 14 patients (36%) in this series. When the two patients who received postoperative pelvic irradiation alone (excluding the para-aortic lymph nodes) after unilateral
oophorectomy are included, this frequency increases slightly to 6 of 16 patients (38%). The risk of recurrence of disease after surgical treatment alone has been reported to be 17 to 52.8%. In a large series reported by Asadourian and Taylor, recurrent disease developed in 10 of 46 patients (22%) after unilateral oophorectomy alone for stage IA1 dysgerminoma. The relatively wide range of risk of recurrent disease after surgical treatment alone is not surprising, inasmuch as many patients included in this and other series had their initial surgical treatment many years ago or provided by surgeons who were not specialists in oncology. The risk of recurrence of disease in patients who have thorough surgical and radiologic staging should be less than the 36% found in this retrospective series. Unlike Krepart and colleagues, who recommended postoperative radiation therapy for patients who had tumors that exceeded 10 cm in diameter, we were unable to find any correlation between the size or mass of the unilateral resected tumor and the risk of recurrence of disease. Only 3 of the 39 ovarian tumors in the 35 patients in our study were smaller than 10 cm.

The anatomic areas of treatment failure after unilateral oophorectomy for stage IA1 disease in this series included the ipsilateral common iliac and para-aortic lymph nodes, the mediastinum, the left supraclavicular fossa, and the lungs. No failures involving the peritoneal cavity were noted in the patients with stage IA1 tumors. These sites of failure are consistent with the lymphatic drainage of the ovaries. As all initial abdominal treatment failures in the patients with stage IA1 lesions occurred in the para-aortic or ipsilateral common iliac lymph nodes, postoperative prophylactic treatment of these areas with a radiation dose of 2,000 to 2,500 cGy should almost eliminate the possibility of treatment failure in these anatomic sites.

In order to determine the dose to the contralateral ovary when a dose of 2,000 cGy is used for the ipsilateral common iliac lymph nodes and para-aortic lymph nodes (Fig. 5), we placed thermoluminescent dosimetry capsules in a phantom at location of contralateral ovary—was found to be insufficient to produce sterilization. This treatment should
considerably decrease the risk of failure in these areas without inducing sterility and with a very minimal and unproven risk of inducing congenital abnormalities.

The question of whether the mediastinum should be treated prophylactically in patients with involvement of para-aortic lymph nodes has been addressed in patients with a diagnosis of seminoma. Of 86 patients with stage II seminoma treated with abdominal irradiation alone at the Princess Margaret Hospital, 10 (12%) had treatment failure in the mediastinum or supraclavicular lymph node regions. Seven of the 10 patients were subsequently cured with further irradiation. In a recent Mayo Clinic series, 15 patients with stage II bulky seminoma (abdominal lesions greater than 5 cm) received irradiation to the abdomen followed by prophylactic irradiation to the mediastinum and supraclavicular lymph nodes. Only 1 of the 15 patients had a treatment failure in the previously irradiated mediastinum. This patient was rendered disease-free with further irradiation. Four of eight patients in this series who did not receive prophylactic mediastinal and supraclavicular lymph node irradiation had recurrent disease in these regions in comparison with none of five patients who did receive prophylactic irradiation to the mediastinum and supraclavicular lymph node region. All four patients who had involvement of the mediastinum and supraclavicular lymph node regions were rendered free of disease with radiation therapy or combination chemotherapy. The small number of patients in each group precludes meaningful statistical comparison.

The dose-response analysis revealed no in-field failures in 41 anatomic areas treated prophylactically with radiation doses that ranged from 1,000 to 3,650 cGy (median, 2,500 cGy), and only one definite in-field failure was noted in 21 areas treated for gross disease with radiation doses that ranged from 1,300 to 4,800 cGy (median, 3,100 cGy). These findings are consistent with the well-known sensitivity of these tumors to ionizing irradiation. Therefore, doses of 2,000 cGy should be adequate for prophylactic treatment of areas of potential tumor involvement. We were unable to obtain accurate measurements of the size of the gross lesions treated in this series. Therefore, no definite statements can be made about recommended dose of irradiation to control lesions of specific sizes. Because the radiosensitivity of this tumor seems comparable to the testicular seminoma, however, doses of 3,500 to 4,000 cGy should be adequate to control most sites of gross disease.

Currently, because of better understanding of radiation therapy and the availability of other treatment modalities, the two fatal complications of pulmonary fibrosis and nephritis in this study could now be avoidable. With effective chemotherapy available, radiation therapy would rarely be used for treatment of lung metastatic lesions. If radiation therapy were to be recommended for gross pulmonary metastatic lesions, however, the present knowledge of pulmonary tolerance of ionizing irradiation would preclude giving the total dose of 2,875 cGy to the entire lung volume as was delivered in 1959. The death due to a clinical diagnosis of nephritis is much more difficult to understand, as the total radiation dose to both kidneys was 2,100 cGy delivered in 1967 with 6 MeV photons. Whole-abdomen irradiation has been used extensively in the treatment of epithelial ovarian carcinoma, including the entire renal volume to doses of 2,000 cGy, without associated clinical nephritis.

RECOMMENDATIONS

With careful staging, including ipsilateral pelvic and para-aortic lymphadenectomy, patients with stage IA1 dysgerminoma should have a less than 36% risk of relapse after unilateral oophorectomy alone, and most patients who have a relapse may be salvaged with radiation therapy. Therefore, in patients with stage IA1 tumors who have undergone unilateral oophorectomy, two options of treatment seem reasonable. Our policy has been close observation alone for a minimum of 5 years and reservation of irradiation for patients who have a relapse. The second option is to deliver 2,000 cGy to the ipsilateral common iliac and para-aortic lymph nodes, which should almost eliminate the risk of relapse without loss of fertility and with no evidence of increased risk of congenital abnormalities. This dose of 2,000 cGy would not preclude giving additional irradiation to the abdomen or combination chemotherapy if relapse were to occur.

As treatment failure within the peritoneal cavity can occur in patients who are found to have excrescences on the surface of the ovary, positive cytologic findings, or adhesions in the pelvis, our current practice is to deliver 2,000 cGy to the
whole abdomen in patients with these features. Areas of gross disease are given a boost dose of 3,500 to 4,000 cGy.

Inasmuch as four of eight patients with gross para-aortic disease in our study had recurrent disease in the mediastinum or supraclavicular region when treated with abdominal irradiation alone, our current policy is to use prophylactic mediastinal irradiation in such patients.

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