

Modified and Bilateral Retroperitoneal Lymph Node Dissection for Testicular Cancer: Peri- and Postoperative Complications and Therapeutic Outcome

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Received January 24, 2006; accepted March 21, 2006; published online June 8, 2006

Objective: To characterize surgical invasiveness and morbidity and to verify therapeutic efficacy, we reviewed perioperative and postoperative courses and therapeutic outcomes of patients who underwent retroperitoneal lymph node dissection (RPLND) for testicular germ cell cancers.

Methods: The study included 31 patients who underwent retroperitoneal lymph node dissection. A modified template was used if retroperitoneal metastasis was limited to the areas below the level of the renal hilus and above the level of the inferior mesenteric artery (IMA). Perioperative and postoperative courses and complications were reviewed as well as therapeutic outcomes.

Results: Overall, 27 perioperative and postoperative complications were observed in 15 patients (48.4%). Superficial surgical site infection and paralytic ileus were seen most frequently. All of them were resolved without special additional treatments; however, patients who underwent retrocrural dissection had a tendency to have severe symptomatic complications such as chylothorax, phrenic nerve palsy and orthostatic hypotension. Antegrade ejaculation was preserved in 94.1% of patients with modified template dissection, whereas no patients with additional dissection below the level of the IMA had the function preserved. One patient (3.2%) developed a postoperative recurrent disease in the retroperitoneum, which was outside the dissection field, as well as in the mediastinum.

Conclusions: Although RLND had high morbidity, most peri- and postoperative complications were manageable conservatively. Modified template dissection enabled patients to preserve antegrade ejaculation without compromising its therapeutic efficacy, if the disease extension allowed us to use the template.

Key words: testicular neoplasm – retroperitoneal space – metastasis – lymph node excision – complications

INTRODUCTION

In patients with testicular germ cell cancer, retroperitoneal lymph node dissection (RPLND) is indicated for both staging and treatment of patients with low-stage disease. In addition, the surgery is recommended for those with advanced disease with residual masses after chemotherapy to remove teratomas and to verify their histology so as to select patients who need additional chemotherapy.

Bilateral radical RPLND including dissection of the suprahilar region is a traditional, standard procedure. However, the surgery has a high rate of perioperative and postoperative complications (1). Moreover, the morbidity may be increased

in patients who undergo chemotherapy before surgery (2–5). To reduce the complication rate, a template limited to the infrahilar region has become common as it provides sufficient therapeutic efficacy for low-stage testis cancer, whereas application of suprahilar dissections is limited to patients with metastatic disease in the suprahilar region (1,6). In addition, to prevent loss of antegrade ejaculation, which is one of the common late complications, a nerve-sparing procedure or modified template is also used (3,4,7–9).

Modified template dissection is widely accepted for primary RPLND in patients with low-stage disease, though there is still controversy regarding the appropriate template for post-chemotherapy RPLND in those with advanced disease. Several recent studies reported that modified template dissection combined with resection of residual masses is sufficient for therapeutic purposes even in patients with advanced disease who have undergone successful chemotherapy (10–12).

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We used modified template dissection if the pre-chemotherapy disease extension and the post-chemotherapy residual-mass area allowed us to do so. Unless the retroperitoneal mass was bulky or widespread, we did not perform bilateral RPLND. In the present study, to characterize the surgical invasiveness and morbidity of RPLND and to verify its therapeutic efficacy, we reviewed perioperative and postoperative courses as well as therapeutic outcomes of patients who underwent the surgery at our hospital.

PATIENTS AND METHODS

Between 1992 and 2005, 31 patients with testicular cancer, consisting of 30 with nonseminomatous germ tumor (NSGCT) histology and 1 with seminoma, underwent RPLND at our hospital. Clinical stage was determined according to the UICC (TNM) tumor stage classification (13) and International Germ Cell Consensus Classification (14). Of the 31 patients, 29 with clinical stage IIA or higher stage received 3 or more cycles of platinum-based chemotherapy prior to RPLND. The exceptions were one patient with clinical stage I and one with clinical stage IIA. The first-line chemotherapy regimens consisted of pepleomycin, etoposide and cisplatin (PVPe) between 1992 and 1994 and of bleomycin, etoposide and cisplatin (BEP) from 1995 and thereafter. As the second-line regimen, etoposide, ifosphamide and cisplatin (VIP) or paclitaxel, ifosphamide and cisplatin (TIP) were used. Third-line chemotherapy with high-dose ifosphamide, carboplatin and etoposide (high-dose ICE) or combination of irinotecan and nedaplatin was used for patients who did not have normalization in tumor markers despite the second-line treatment. Serum levels of tumor markers such as human chorionic gonadotropin (HCG), HCG- β , α -fetoprotein (AFP) and lactate dehydrogenase (LDH) were normalized before RPLND in all but one patient, in whom the serum HCG- β level was 0.7 mIU/ml (normal \leq 0.1 mIU/ml) after eight cycles of chemotherapy, including third-line high-dose chemotherapy.

Before RPLND, all patients were confirmed to have bone marrow, pulmonary, liver and renal functions adequate for surgery. Intervals from the last day of chemotherapy to surgery ranged from 4 to 8 weeks. Antimicrobial chemotherapy with the first or second generation of cephalosporin or one of the penicillins was started before surgery and continued for 3 days, including the day of operation.

Modified template dissection was used when it included the area of pre-chemotherapy disease extension and that of the post-chemotherapy residual mass, both of which were identified by image diagnosis. In patients with a right-side primary lesion, the modified template included paracaval, precaval and aortocaval lymph nodes between the level of renal vessels and the bifurcation of the right common ileac artery, and preaortic lymph nodes between the level of renal vessels and the inferior mesenteric artery (IMA) (15). In patients with a left-side primary tumor, the template included preaortic, aortocaval and precaval lymph nodes between the level of renal vessels and the IMA in addition to paraaortic lymph nodes between

the level of renal vessels and the bifurcation of the left common ileac artery. When metastatic masses extended below the IMA, dissection of the area below the IMA was added to the modified template. Bilateral radical RPLND was employed for patients with metastatic lesions widely spread in extensive areas of the retroperitoneum before chemotherapy. When metastatic masses were present in the suprahilum or retrocrural area, dissection of the area was added. In most patients, the thoracoabdominal approach was used, though the extraperitoneal approach with flank incision and transperitoneal approach with midline incision were also employed according to the preference of the surgeon.

The type of template used and perioperative and postoperative complications were compiled. Subtle clinical signs observed in postoperative courses were also considered complications, even if they were asymptomatic.

To assess operative invasiveness, the operating time, amount of blood loss and duration until when diet started were reviewed.

Pre- or perioperative parameters were evaluated to determine the risk of perioperative or postoperative complications by using univariate logistic regression. *P* values <0.05 were considered to be statistically significant.

The status of ejaculation was investigated by a direct question 6–12 months after operation. Therapeutic outcomes were also reviewed.

RESULTS

Patient characteristics are shown in Table 1. The mean age was 32 years and they were followed-up for a median period of about 3 years. A right-sided primary tumor was found in 16 patients and a left-sided one in 15. All but 1 had metastatic disease in the retroperitoneum. Most patients had bulky or extensive lymph node metastasis in the retroperitoneum. The serum level of HCG was not measured in 14 patients, leaving 17 who were categorized by the IGCCC. More than half of the patients were classified into the intermediate or poor prognosis group. Primary RPLND was performed for two patients and the remainder underwent chemotherapy before RPLND. Of those with prior chemotherapy, 21 underwent RPLND after the first-line chemotherapy. Second-line or subsequent chemotherapy was performed in 8 before RPLND, including 5 with high-dose chemotherapy as the third line. Of two patients who had not undergone prior chemotherapy, one had metastasis of seminoma in the retroperitoneal lymph nodes, and the primary tumor contained mixed germ cell tumors consisting of teratoma and seminoma. In nearly half of the patients with prior chemotherapy, mature teratoma, immature teratoma or viable NSGCT was revealed with histological examination of lymph nodes removed by RPLND.

The relationship between the template used and N classification is indicated in Table 2. A modified template was used in 22 patients. Dissection in the region below the IMA in addition to the modified template was done in 3, all of whom had the primary disease in the left testis and metastasis

Table 1. Patient characteristics

No. of patients	31
Mean age at RPLND: years (range)	31.8 (16–52)
Median follow-up period: months (range)	34.0 (2–153)
N classification (<i>n</i>)	
N0	1 (3.2%)
N1	7 (22.6%)
N2	13 (41.9%)
N3	10 (32.3%)
Clinical stage (<i>n</i>)	
I	1 (3.2%)
IIA	4 (12.9%)
IIB	6 (19.4%)
IIC	4 (12.9%)
III	16 (51.6%)
N classification (<i>n</i>)	
N1	3 (18.8%)
N2	8 (50.0%)
N3	5 (31.2%)
IGCCC (<i>n</i>)	
No. of patients with available data	17 (54.8%)
Good prognosis	6 (35.3%)
Intermediate prognosis	8 (47.1%)
Poor prognosis	3 (17.6%)
Patients with prior chemotherapy (<i>n</i>)	29 (93.5%)
First-line	21
Second-line	3
High dose (third-line)	5
Histology of retroperitoneal lymph nodes (<i>n</i>)	
Without prior chemotherapy (2)	
Seminoma	1 (50.0%)
No metastasis	1 (50.0%)
With prior chemotherapy (29)	
No viable cells	15 (51.7%)
Mature teratoma	6 (20.7%)
Immature teratoma	5 (17.2%)
NSGCT other than teratoma	3 (10.4%)

RPLND, retroperitoneal lymph node dissection; IGCCC, International Germ Cell Consensus Classification; NSGCT, nonseminomatous germ cell tumor.

in the preaortic and/or common iliac artery areas. Bilateral radical RPLND was done for six patients, including two with retrocrural dissection who had N3 disease. Even in those with N3 disease, a modified template was used if the lesion was limited, although one patient with N1 disease underwent bilateral dissection due to multiple small lesions widely spread in the retroperitoneum.

The surgical approaches employed are also shown in Table 2. The thoracoabdominal approach was used most frequently,

even in patients with bilateral RPLND. The mean (\pm SD) operating time and amount of blood loss were 349.1 min (\pm 179.8) and 824.5 ml (\pm 609.5), respectively. The mean (\pm SD) interval until starting diet was 2.5 days (\pm 1.8).

Totally, 27 perioperative or postoperative complications were seen in 15 (48.4%) patients (Table 3). No such complications were found in 16 patients, none of whom had undergone bilateral radical RPLND with retrocrural dissection. Intraoperative complications included injury to the ureter, inferior vena cava and aorta, which were repaired intraoperatively without any serious consequences. Postoperatively, transient hydronephrosis, atelectasis, paralytic ileus and superficial surgical site infection, as defined by the Centers for Disease Control and Prevention (16), were commonly observed. The two patients who underwent retrocrural dissection experienced multiple symptomatic complications such as chylothorax, phrenic nerve palsy and orthostatic hypotension, all of which needed several weeks to be resolved. On the other hand, bilateral radical RPLND without retrocrural dissection had a relatively low incidence of complications.

Table 4 shows results of univariate analysis for risk factors of perioperative complications. There was no significant pre- or intraoperative parameter that was a risk for complications, although patients who underwent second-line or later chemotherapy tended to have higher morbidity.

Ejaculatory function was evaluated in 26 patients by a direct question about the current status (Table 4). Of them, 2 patients had no chance for ejaculation, leaving 24 patients for evaluation. Eight patients (33.3%), including one with a modified template dissection, lost antegrade ejaculation, which was preserved in 16 patients, all of whom underwent RPLND with a modified template. Of them, one patient experienced a reduction of ejaculate volume.

After RPLND, one patient (3.2%) had recurrent disease in the retroperitoneum, which was outside the RPLND area (Table 5). The patient also concomitantly developed distant metastasis in the mediastinum. He is now undergoing second-line chemotherapy. Two patients who developed distant metastasis without retroperitoneal recurrence died from the disease in spite of subsequent intensive chemotherapy. The patients other than these three were alive without any evidence of disease during the follow-up period.

DISCUSSION

In patients with advanced germ cell tumors for whom chemotherapy achieves remarkable effects, the necessity of RPLND is still controversial. Some investigators have suggested that for patients with necrotic tissue in the retroperitoneal lymph nodes, factors such as the pre-chemotherapy tumor size (17), size of residual the mass, extent of shrinkage of the mass, pretreatment tumor markers and histology of the primary lesion can be used as indicators for those who can safely avoid post-chemotherapy RPLND (18,19). However, ~20% of patients who met these criteria still had a viable tumor or teratoma in the retroperitoneum (20). Although

Table 2. Template used in relation to clinical N stage and surgical approaches

	Template for RPLND				Total
	Modified		Left modified + below IMA	Bilateral (with retrocrural)	
	Right	Left			
Total	22 (71.0%)		3 (9.7%)	6 (19.3%)	31
N stage					
N0	1	–	–	–	1
N1	5	1	–	1	7
N2	4	5	2	2	13
N3	1	5	1	3 (2)	10
Subtotal	11	11			
Approach					
Thoracoabdominal		17	2	4 (1)	23 (74.2 %)
Transabdominal with midline incision		2	1	2 (1)	5 (16.1 %)
Extraperitoneal with flank incision		3			3 (9.7 %)

RPLND, retroperitoneal lymph node dissection; IMA, inferior mesenteric artery; with retrocrural, with retrocrural dissection.

Table 3. Perioperative and postoperative complications

Template	Retrocrural dissection			Total
	Yes	No		
		Bilateral	Modified	
No. of patients	2	4	25	31
No. of patients with complications (%)	2 (100)	1 (25.0)	12 (48.0)	15 (48.4)
Intraoperative complication				
Injury of ureter		1	2	3
Injury of IVC			1	1
Injury of aorta			1	1
Postoperative complication				
Superficial SSI			3	3
Paralytic ileus	1		2	3
Atelectasis	1		1	2
Chylothorax	1		1	2
Renal infarction			2	2
Hydronephrosis		1	1	2
Lymphocele	1			1
Phrenic nerve palsy	1			1
Orthostatic hypotension	1			1
Pleural effusion	1			1
Femoral neuropathy			1	1
DVT			1	1
CVC-related infection			1	1
Decubitus			1	1

IVC, inferior vena cava; SSI, surgical site infection; DVT, deep venous thrombosis; CVC, central venous catheter.

Table 4. Postoperative status of ejaculation

	Modified template (n = 17)	Dissection below the IMA (n = 7)	Total (n = 24)
Antegrade ejaculation	16 (94.1%)	0 (0%)	16 (66.7%)
Antegrade ejaculation with volume reduction	1		
Loss of antegrade ejaculation	1 (5.9%)	7 (100%)	8 (33.3%)

IMA, inferior mesenteric artery.

RPLND has a high complication rate, most complications are reversible, except for the loss of antegrade ejaculation. Hence, we think that RPLND is indicated basically for patients with advanced testicular cancer.

RPLND is an invasive surgical procedure, so potential complications should be understood for better care of patients (5,21). We experienced surgery-related complications such as paralytic ileus, surgical site infection, atelectasis and chylous ascites, which were similar to those reported by other investigators (3–5,11,21–23).

Resection with a modified template was reported to result in less morbidity than radical bilateral RPLND (3,4). Although the majority of patients underwent dissection with a modified template in the present study, the overall complication rate of 48.4% was higher than those of other reports (2,5,7,11,21,22). In spite of the high incidence, no complications in our study required special additional interventions for their management. This result suggested that the definition of complications was different from those in other reports, which might account for the higher incidence in the study.

Table 5. Patients with disease recurrence after retroperitoneal lymph node dissection

Age (years)	Clinical stage	Histology of L/N	Site of recurrence	Outcome	Period after RPLND (months)
44	IIB	No viable cells	Retrocrural L/N retrocaval L/N mediastinum	Alive with disease	9
29	IIIB	Viable cancer	Lung liver	Died of disease	19
25	IIB	Immature teratoma	Lung brain	Died of disease	7

L/N, lymph node; RPLND, retroperitoneal lymph node dissection.

Suprahilar dissection has a higher risk for intraoperative morbidity such as injury to vessels or adjacent organs (1,2). In our series, the complication rate was not significantly higher in patients with bilateral radical RPLND including suprahilar dissection than in those with modified template dissection. However, in patients with retrocrural dissection, neurological complications such as autonomic nerve disturbance and phrenic nerve palsy were observed, which did not occur in those without retrocrural dissection. There is no other report that has referred to neurological complications other than femoral neuropathy, which may be caused by intraoperative traction or compression by retractors. Although it is unclear whether autonomic nerve disturbance or phrenic nerve palsy is a distinctive complication related to RPLND with retrocrural dissection, we should be aware of the possibility. We do not know how we can avoid such complications; however, careful observation of patients and prompt management of the complications should help reduce their severity.

In our series, no one had a recurrence in the operative field of RPLND. The efficacy of a limited template with residual-mass resection is supported by several investigators for post-chemotherapy RPLND (10–12), although there has been controversy concerning this issue. In addition, the goal of post-chemotherapy RPLND can be achieved by resection of the residual mass with or without limited template dissection, because teratoma or viable cells are rarely identified in the area outside the residual mass (20,24). Our results also suggest that bilateral RPLND is not always necessary and modified template dissection provides sufficient therapeutic efficacy for most patients if candidates are properly selected. Thus, they should be selected by the extent of the retroperitoneal disease before chemotherapy and the area of the residual mass as well as tumor marker status.

In the present study, three patients who underwent modified RPLND had disease recurrence. Of these three patients, two had recurrence in distant organs without disease in the retroperitoneum. Only one patient presented with a retroperitoneal mass with necrotic histology in the surgical specimens in an area outside of RPLND on the contralateral side. Although retroperitoneal recurrence could have been avoided by bilateral radical RPLND in this patient, concomitant distant metastasis may reflect the aggressive biological character of his cancer. It is clear that not all patients with advanced disease are indicated for a modified template with resection of the residual mass even after successful chemotherapy. More

appropriate parameters may allow us to precisely select candidates for RPLND with a modified template.

In the present study, modified template dissection provided good results for preservation of antegrade ejaculatory function. The preservation rate of 94.1% was satisfactory compared with those of other reports (5,12). Although there is a report that indicates favorable outcomes of nerve-sparing bilateral radical RPLND for preservation of ejaculatory function, the current study does not allow comparison of the procedure with the modified template. In addition, there is no study that compares clinical outcomes of nerve-sparing bilateral RPLND and modified template dissection. Thus, at this moment, the choice may depend on the patients' and urologists' preferences. Jacobsen et al. (9) reported that at least 50% of patients who attempted fatherhood could achieve paternity after post-chemotherapy nerve-sparing RPLND with a modified template. Therefore, even in our study, an equal result for paternity can be expected. On the other hand, in patients who undergo dissection caudal to the IMA, loss of antegrade ejaculation cannot be avoided unless a meticulous nerve-sparing procedure is used. Taking into consideration that spermatogenesis of the contralateral testis is not guaranteed, sperm cryopreservation before chemotherapy may be recommended for such patients who hope for fatherhood in the future (25).

CONCLUSIONS

RPLND has high morbidity even when modified template dissection is used. However, most perioperative and postoperative complications can be conservatively managed without the need for special treatments. In patients with retrocrural dissection, severe symptomatic complications may not be avoidable, but they are transient and manageable. Antegrade ejaculation is preserved by modified template dissection, which does not compromise its therapeutic efficacy when the indication for the surgery is appropriately decided.

References

1. Sheinfeld J, Mckiernan J, Bosl GJ. Surgery of testicular tumors. In: Walsh PC, Retik AB, Vaughan ED, Wein AJ, editors. *Campbell's Urology*, 8th edn. Philadelphia, PA: Saunders, 2002; Vol 4:2920–44.
2. Donohue JP, Rowland RG. Complications of retroperitoneal lymph node dissection. *J Urol* 1981;125:338–40.
3. Baniel J, Foster RS, Rowland RG, Bihle R, Donohue JP. Complications of primary retroperitoneal lymph node dissection. *J Urol* 1994;152:424–7.

4. Baniel J, Foster RS, Rowland RG, Bihrlé R, Donohue JP. Complications of primary retroperitoneal lymph-node dissection for low-stage testicular cancer. *World J Urol* 1994;12:139–42.
5. Baniel J, Sella A. Complications of retroperitoneal lymph node dissection in testicular cancer: primary and post-chemotherapy. *Semin Surg Oncol* 1999;17:263–7.
6. Donohue JP, Zachary JM, Maynard BR. Distribution of nodal metastasis in nonseminomatous testis cancer. *J Urol* 1982;128:315–20.
7. Wahle GR, Foster RS, Bihrlé R, Rowland RG, Bennett RM, Donohue JP. Nerve sparing retroperitoneal lymphadenectomy after primary chemotherapy for metastatic testicular carcinoma. *J Urol* 1994;152:428–30.
8. Coogan CL, Hejase MJ, Wahle GR, Foster RS, Rowland RG, Bihrlé R, et al. Nerve sparing post-chemotherapy retroperitoneal lymph node dissection for advanced testicular cancer. *J Urol* 1996;156:1656–8.
9. Jacobsen KD, Ous S, Wæhre H, Trasti H, Stenwig AE, Lien HH, et al. Ejaculation in testicular cancer patients after post-chemotherapy retroperitoneal lymph node dissection. *Br J Cancer* 1999;80:249–55.
10. Wood DP, Herr HW, Heller G, Vlamis V, Sogani PC, Motzer RJ, et al. Distribution of retroperitoneal metastases after chemotherapy in patients with nonseminomatous germ cell tumors. *J Urol* 1992;148:1812–16.
11. Herr HW. Does necrosis on frozen-section analysis of a mass after chemotherapy justify a limited retroperitoneal resection in patients with advanced testis cancer? *Br J Urol* 1997;80:653–7.
12. Rabbani F, Goldenberg SL, Gleave ME, Paterson RF, Murray N, Sullivan LD. Retroperitoneal lymphadenectomy for post-chemotherapy residual masses: is a modified dissection and resection of residual masses sufficient? *Br J Urol* 1998;81:295–300.
13. Sobin LH, Wittekind Ch, editors. TNM classification of malignant tumors. 6th edn. Hoboken: John Wiley & Sons; 2002.
14. The International Germ Cell Cancer Collaborative Group. International Germ Cell Consensus Classification: a prognostic factor-based staging system for metastatic germ cell cancers. *J Clin Oncol* 1997;15:594–603.
15. Foster RS. Modified retroperitoneal lymphadenectomy. *BJU Int* 2004;94:941–55.
16. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Hospital Infection Control Practice Advisory Committee. Guideline for prevention of surgical site infection, 1999. *Infect Control Hosp Epidemiol* 1999;20:250–78.
17. Murakami M, Hara I, Miyake H, Yamada Y, Okada H, Kamidono S. Clinical outcome of retroperitoneal lymph node dissection after induction chemotherapy for metastatic non-seminomatous germ cell tumors. *Int J Urol* 2004;11:763–7.
18. Donohue JP, Rowland RG, Kopecky K, Steidle CP, Geier G, Ney KG, et al. Correlation of computed tomographic changes and histological findings in 80 patients having radical retroperitoneal lymph node dissection after chemotherapy for testis cancer. *J Urol* 1987;137:1176–9.
19. Toner GC, Panicek DM, Heelan RT, Geller NL, Lin SY, Bajorin D, et al. Adjunctive surgery after chemotherapy for nonseminomatous germ cell tumors: recommendations for patient selection. *J Clin Oncol* 1990;8:1683–94.
20. Kuczyk M, Machtens S, Stief C, Jonas U. Management of the post-chemotherapy residual mass in patients with advanced stage non-seminomatous germ cell tumors (NSGCT). *Int J Cancer* 1999;83:852–5.
21. Gels ME, Nijboer AP, Hoekstra HJ, Sleijfer DT, Molenaar WM, Plukker JT, et al. Complications of the post-chemotherapy resection of retroperitoneal residual tumour mass in patients with non-seminomatous testicular germ cell tumours. *Br J Urol* 1997;79:263–8.
22. Christmas TJ, Doherty AP, Rustin GJS, Seckl MJ, Newlands ES. Excision of residual masses of metastatic germ cell tumours after chemotherapy: the role of extraperitoneal surgical approaches. *Br J Urol* 1998;81:301–8.
23. Mosharafa AA, Foster RS, Koch MO, Bihrlé R, Donohue JP. Complications of post-chemotherapy retroperitoneal lymph node dissection for testis cancer. *J Urol* 2004;171:1839–41.
24. Tekgul S, Ozen HA, Celebi I, Ozgu I, Ergen A, Demircin M, et al. Postchemotherapeutic surgery for metastatic testicular germ cell tumors: results of extended primary chemotherapy and limited surgery. *Urol* 1994;43:349–54.
25. Kuczyk M, Machtens S, Bokemeyer C, Schulthesis D, Jonas U. Sexual function and fertility after treatment of testicular cancer. *Curr Opin Urol* 2000;10:473–7.