Testicular cancer: diagnostic and surgical strategies to improve outcome
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Posterior Retroperitoneoscopic Resection of Recurrent Nonseminomatous Tumor Mass: A Report of the Surgical Procedure with a Review of the Literature
Abstract

Background
Treatment of stage II-IV nonseminomatous testicular germ cell tumors (NSTGCT) consists of cisplatin based combination chemotherapy and, when present, resection of residual retroperitoneal tumor mass (RRRTM) by conventional laparotomy or laparoscopy. In case of a retroperitoneal recurrence, a second conventional or laparoscopic procedure may be challenging.

Methods
A case of late relapse after prior conventional resection of a residual retroperitoneal tumor mass (RRTM) and the tailor made surgical management with a posterior retroperitoneoscopic resection is reported and the literature reviewed.

Results
The retroperitoneoscopic procedure was performed in a 26-year old male with a history of stage IIC NSTGCT, presenting with a late left sided retroperitoneal relapse, 6 years after initial treatment. The retroperitoneal cavity was entered through an alternative route by posterior retroperitoneoscopic resection of the RRTM. Histology showed mature teratoma. Postoperative course was uneventful and with a one year follow up the patient had no evidence of disease.

Conclusion
Reoperative surgery by a minimal invasive retroperitoneoscopic approach should be considered as an alternative approach for patients with a recurrent retroperitoneal tumor mass of a NSTGCT.

Introduction
Testicular germ cell tumors are rare tumors in the general population, but form the most common malignancy among men aged between 20-39 years\(^1\). In the last decades cisplatin based combination chemotherapy in the treatment of advanced nonseminomatous testicular germ cell tumor (NSTGCT) has impacted survival rates significantly, with an overall 10-year survival rate of up to 90%\(^2,3\). According to the prognostic classification, patients with advanced NSTGCT receive three or four courses of BEP (bleomycin, etoposide and cisplatin) after which restaging is performed with tumor marker analysis and computed tomography (CT) scanning of chest and abdomen. A wait and see policy is conducted in NSTGCT when tumor markers are normalized and no residual disease is detected (Figure 1).

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Figure 1
Summary of primary treatment of high stage NSTGCT.
Surgical resection is indicated in case of residual disease after chemotherapy. Most frequently this residual disease manifests as residual retroperitoneal tumor mass (RRTM) or in the lungs. The role of surgery in case of residual disease in NSTGCT treated with chemotherapy is to resect viable germ cell cancer and/or teratoma usually via a classical approach performing a conventional open midline laparotomy. Laparoscopic surgery is mainly reserved for staging and treatment of low-stage disease, although at the UMCG low volume RRTM is also laparoscopically resected. In 8% of the NSTGCT patients that have been treated by combined therapy, e.g. chemotherapy and adjunctive surgery, recurrent disease was encountered. Management is related mainly to the type of recurrence; growing teratoma, viable germ cell cancer or a secondary malignancy. In case of growing teratoma a resection is performed, whereas in case of presumed viable germ cell cancer the initial treatment will be chemotherapy followed by resection of residual tumor mass if indicated.

Relapses after prior conventional resections of RRTM are usually located in the retroperitoneum requiring extensive surgical exploration when the approach is conducted via laparotomy. An alternative surgical approach, the posterior retroperitoneoscopic resection (PRR), a surgical approach as used in the treatment of adrenal tumors, is described for the tailored resection of a recurrent RRTM with review of the current literature.

**Case Representation**

A 26 year old man was first diagnosed in 2008 with a left sided testicular tumor treated with inguinal orchiectomy. The resection specimen showed primarily embryonal carcinoma and teratoma. The disease was staged according to the Royal Marsden Classification system in stage IIC NSTGCT and IGCCCG (International Germ Cell Cancer Collaborative Group) intermediate risk group. The patient received 4 courses of cisplatin based combination chemotherapy (BEP). Restaging procedures revealed normalised alpha-fetoprotein (AFP) and a normal betachoriongonadotropin <1 U/L. Furthermore, CT scan of thorax and abdomen showed a left sided retroperitoneal paraaortic tumor mass, situated caudally of the renal hilus, measuring 6x7 cm (prior 5x5cm) and a second retroperitoneal tumor mass situated interaortocaval measuring 1.7x1.9 cm (prior 2.6x3cm) (Figure 2a). Subsequently, the patient underwent a conventional midline laparotomy to resect the residual retroperitoneal tumor masses. Histopathology results showed a complete (R0) resection and surgical specimens consisted of fibrotic tissue and teratoma with mature and immature compounds. Normally, follow-up is performed according to the ESMO guidelines with testicular tumor markers and abdominal and chest CT. However there was a lack of patient adherence to the follow up schedule due to relocation abroad. He presented himself 6 years later with a request to resume follow up. There were no presenting symptoms at that time. Unfortunately a retroperitoneal recurrence located at the left retrocrustral space with a diameter of 17 mm (Figure 2b) with normal tumor markers was diagnosed 87 months after initial resection of RRTM. The recurrence, diagnosed to be suggestive for a growing teratoma, was located far from the initial residual disease location and previous operative resection area. The patient was discussed in the weekly multidisciplinary tumor board and it was decided to implement a posterior retroperitoneoscopic resection of the recurrent disease. The goal was to select the procedure with the highest chance of a complete resection of this late relapse with a minimal treatment related morbidity and a fast recovery and without surgically dealing with scarred tissue and adhesions of a prior operation field.

**Surgical Procedure and Postoperative Course**

Two surgical oncologists performed the surgical procedure with laparoscopic experience in performing posterior retroperitoneoscopic adrenalectomy (PRA). The retroperitoneoscopic procedure was performed with the patient in the prone position. Figure 2a shows a CT scan showing retroperitoneal tumor masses. Figure 2b shows a CT scan showing retroperitoneal disease recurrence.
position and the surgeon positioned ipsilateral to the tumor, with the assistant at the opposite side holding the camera. Two video monitors were placed near the patient’s head to provide a comfortable view for both surgeons. The first part of the surgery involved introduction and developing sufficient retroperitoneal space with blunt dissection and carbon dioxide instillation. A first incision was made below the tip of the 12th rib of about 1.5 cm, eventually serving as a camera port and the second port was then placed without camera view on the index finger (Figure 3). Pneumoperitoneum was created with a high pressure of 25 mm Hg. After having created enough working space a third 10 mm port was placed under camera view. Firstly, the left renal hilus was exposed mobilizing the left kidney from its surroundings. After mobilizing the kidney laterally, the tumor mass then could be identified. Resection of the tumor was performed according to the same oncological principles as in a conventional resection of a RRTM excising only the visible abnormal retroperitoneal tumor mass, as previously described. Proximal dissection was carefully performed around the left renal artery and vein. The tumor was gently separated off the aorta by blunt and sharp dissection. Finally, the resected retroperitoneal tumor mass was placed in an endoscopy bag and extracted from the extraperitoneal cavity through the first incision site. Procedure time was 120 minutes. No intra operative complications occurred during the procedure.

The postoperative course was uneventful. The patient was discharged the next day. The resection specimen showed a R0 resection of a retroperitoneal tumor mass with remnants of mature teratoma. During the following 12 months of follow-up the patient had no evidence of disease with normal tumor markers and a normal abdominal and chest CT (Figure 4).

Discussion

Based on the current literature roughly 3-23% of the advanced NSTGCT patients develop a recurrence after previous standard cisplatin based combination chemotherapy with or without resection of residual disease. Surgical resection of residual disease is required by either a modified retroperitoneal lymph node dissection (RPLND), or nerve sparing RPLND, or only resection of residual retroperitoneal tumor mass (RRRTM). Extra template disease in NSTGCT, occurring outside these resection templates and the corresponding histologic distribution is nearly identical to the histologic distribution within the surgical templates with initial RPLND as well as post-chemotherapy RPLNDs. Twenty to thirty percent of patients with advanced NSTGCTs relapse or fail to achieve a complete response with cisplatin based combination chemotherapy. This also depends on the prognostic factor-based staging system of the International Germ Cell Cancer Collaborative Group: good, intermediate or poor risk group. At the UMCG the current relapse rate in advanced NSTGCT patients treated with cisplatin based combination chemotherapy and, if indicated, resection of all visible residual disease, is 18%. Histology shows that teratoma is often present in late relapses and reoperative surgery. Since teratoma is unresponsive to both chemotherapy and radiotherapy, complete resection of all residual tumor masses is an essential part of the combined treatment of NSTGCTs. Also mature

Figure 3.
Schematic positioning of a patient in the prone position during the retroperitoneoscopic procedure to excise the RRTM. *Arrow is directed at the port positions; in the middle the camera port is shown.

Figure 4.
CT scan postoperatively. *Arrow is directed at the adrenal which was not damaged during procedure.
teratoma can dedifferentiate into malignant tissue with either germ cell or non-germ cell elements\textsuperscript{19}. Chemotherapy does not compensate for suboptimal surgical resections of residual disease without viable carcinoma. Since these relapses of the retroperitoneum tend to be chemoresistant, a selection of patients with anatomically well-defined retroperitoneal disease require reoperative retroperitoneal surgery in a so-called curative setting. These redo surgeries are accompanied by significant morbidity and risks and can be technically challenging procedures because of postchemotherapy desmoplastic reaction and annihilated and scarred surgical tissue planes with dense adhesions due to prior surgery\textsuperscript{25-27}. All of these factors increase the possibility of adjunctive resections such as a nephrectomy, resection of visceral structures and obliged vascular surgery. Long term survival varies from 63% to 91.3% and is therefore worse than patients requiring postchemotherapy resection of residual disease alone\textsuperscript{26,27}. Factors such as histological type of the recurrence, the possibility of salvage chemotherapy, the anatomical site of the recurrence and the experience of the surgical oncologist can explain this wide variance in survival rates. Literature concerning reoperative retroperitoneal surgery in NSTGCTs is limited, although surgery is critical in achieving durable complete remissions. Understanding the typical dissemination patterns of this disease is essential for the surgical oncologist. Lymphatic drainage of the retroperitoneum plays a major role in determining this pattern, with the paraaortic and paracaval lymphatics draining behind the crura of the diaphragm. Majority of retroperitoneal recurrences are located in the paraaortic mostly left-sided and interaortocaval regions, making reoperative retroperitoneal surgery challenging\textsuperscript{26}. Patients who are candidates for resection of recurrent disease should first undergo accurate staging with CT of abdomen and chest, sometimes MRI or even PET CT might be required. By using imaging we want to exclude patients with extra-abdominal and non-retroperitoneal disease that cannot be surgically cured. The goal of surgery should always be a Ro resection meaning to resect all abnormal tissue. Pedrosa et al. declared 27% of NSTGCTs patients with a relapse even unresectable after attempting redo surgery\textsuperscript{26}. In the current patient, technical challenges were taken into account upfront. The residual tumor mass was situated at a difficult and challenging retrocrucal location. With the experience and confidence gained from the PRA, the decision was made in the tumor board conference to perform a PRR instead of an approach via conventional midline laparotomy. This way, the previous transabdominal surgical route was bypassed and surgery could be performed partially in a “virgin” territory creating significantly less morbidity. The hospital stay was one day. Today still most of the surgical resections for recurrent NSTGCTs are performed through a conventional midline or transverse exposure. In almost all cases a laparoscopic procedure is not suitable. The retroperitoneoscopic technique as used for adrenalectomy might be an alternative option. However, PRR requires a substantial learning time and is technically challenging\textsuperscript{27-30}.

**Conclusion**

In case of relapse after resection of residual retroperitoneal tumor mass and previous cisplatin based combination chemotherapy for NSTGCTs, alternative surgical strategies may be discussed in the multidisciplinary tumor conference. When anatomically feasible, PRR can avoid the impact of extended conventional surgery or relaparoscopy on the abdominal organs creating less morbidity with respect to bowel and pulmonary function.

**References**


