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ORIGINAL ARTICLE

Leiomyosarcoma of the inferior vena cava

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KEYWORDS
Leiomyosarcoma;
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Summary
Background: Leiomyosarcoma (LMS) of the inferior vena cava (IVC) is a rare tumor with poor prognosis. Optimal treatment includes complete resection of the malignant lesion.
Methods: From 1997 to 2013, eight patients underwent surgery in our department for IVC LMS. LMS was considered to arise from the IVC if the tumor presented intraluminal development or if complete resection (R0) required removal of part of the IVC with an extraluminal mass.
Results: There were two grade 1 tumors (25%), four grade 2 (50%) and two grade 3 (25%). The median length of stay was 16 days and there were no peri-operative deaths. Median of follow-up was 56 months and mean overall survival was 120 months. Mean 3-year survival rate was 87.5%. Six patients (75%) developed a local recurrence. Four patients died from disease progression. Two patients underwent to surgery for recurrence.
Conclusion: IVC LMS have a poor prognosis if surgical resection cannot be achieved. Long-term survival is related to an extensive surgery, in the event of recurrence, surgery should again be proposed and may be effective for controlling disease progression, possibly improving survival.

Introduction

Leiomyosarcoma (LMS) of the inferior vena cava (IVC) is a rare tumor but the most frequent vascular tumor. Since the first description by Pearl in 1871, few short series reporting about 470 cases of IVC LMS can be found in the literature [1—3]. About half of venous sarcomas are IVC LMS [4] which account for only 0.5% of all operated soft tissue LMS in adults [5]. Because of this low prevalence, and due to the lack of analytical evidence from large series, no real consensus has been reached on the appropriate management. The prognosis is poor and depends directly on the extent of the surgical resection. Long-term survival has only been observed after curative resection [6]. Reports have been controversial on the

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usefulness of radiation therapy and neoadjuvant or adjuvant chemotherapy [7]. We present eight cases of IVC LMS in patients who underwent curative resection in our department. The aim of this study was to analyze the benefit of extensive and aggressive surgery in IVC LMS.

Material and methods

From 1997 to 2013, eight patients underwent surgery in our department for IVC LMS. The study was reported to the ethics committee that ethically reviewed and approved the research (nº 14.16). Informed consent was obtained from all patients before the procedures. These patients were identified within the exhaustive database of the department of pathology. Data collected from the patient files included: clinical history, preoperative imaging (computed tomography [CT] and/or magnetic resonance imaging [MRI]), operative report, pathology report, and postoperative follow-up and treatments. Preoperative exams such as complete blood test, radiological study with CT or MRI and general condition of patient were analyzed during our multidisciplinary group. All patients attended regular follow-up visits (every six months after the first 3 months of surgery) and none were lost to follow-up.

LMS was considered to arise from the IVC if the tumor presented considerable intraluminal development, if complete resection (R0) required removal of part of the IVC with an extraluminal mass, or if the clinical and surgical findings failed to disclose another origin of the sarcoma [8]. Patients with a history of sarcoma were excluded from this study.

All surgery were performed by the same surgical team.

The French staging system for sarcomas (*Fédération nationale des centres de lutte contre le cancer* [FNCLCC]), which takes into consideration tumor differentiation, mitotic index, and percentage of tumor necrosis, was applied: grade 1 = low-grade; grade 2 = intermediate grade; grade 3 = high-grade [9]. The histology slides of the primary tumor were reassessed by a pathologist from the Institute of Pathology with expertise in soft tissue pathology. In all cases, additional immuno-histochemistry tests were performed to confirm the diagnosis. Second expert opinions from other pathologists were obtained. Segments of the IVC were described according to the current classification: level I (infrarenal), portion of the IVC below the renal veins; level II (middle segment), IVC below the hepatic veins to the level of the renal veins; and level III (suprahepatic), IVC running from the right atrium to the level of the hepatic veins. Local recurrence was defined as tumor relapse at the primary tumor resection site and metastatic disease as tumor growth at any other site. Results are presented as means and standard deviation. Three-year survival was calculated using the Kaplan-Meier method. Disease-free survival (DFS) was determined from the date of operation to the date of first recurrence. Overall survival (OS) was determined from the date of surgery to the date of death or last follow-up.

Results

Patient characteristics are summarized in Table 1. There were six women and two men, median age 65.5 years (range: 30—77 years). Median tumor size was 4 cm (range: 3—24 cm). In seven cases (87.5%), the presenting symptom was abdominal pain, in one case (12.5%) intestinal obstruction. None of the patients developed lower limb edema. None of the patients had history of radiation to the abdomen. According to the FNCLCC classification, there were two grade 1 tumors (25%), four grade 2 (50%) and two grade 3 (25%). The tumor involved level II in four patients (50%), levels II and III in two patients (25%) and levels I and II in two patients (25%).

Two patients received neoadjuvant chemotherapy combining doxorubicin and ifosfamide. One patient was a non-responder after four cycles and underwent surgery; the tumor responded in the second patient exhibiting a 25% size reduction after three cycles and 50% reduction after six cycles before resection. Neighboring tissues involved were: right adrenal ($n = 6$, 75%), right kidney ($n = 2$, 25%). In one patient the caudate lobe and the diaphragm were invaded and resected. In another patient, a neoplastic thrombus in the IVC ascended to the right atrium; the thrombus was extracted by cavotomy without need for extra-corporal circulation. IVC resection was performed in 7 patients (87.5%) followed by reconstruction with a PTFE prosthesis measuring 16—20 mm (16 mm, $n = 1$; 18 mm, $n = 3$; 20 mm, $n = 3$). In one patient focal resection was sufficient. In six patients (75%), extended right nephrectomy was associated with IVC resection. For two patients, the left renal vein was ligated but not re-implanted; physiological drainage via the left gonadic vein was checked on the CT scan with injection and considered sufficient. None of the patients developed renal failure postoperatively, but one young patient (30 yrs) did require right nephrectomy. In order to protect this patient's remaining kidney, the left renal vein was re-implanted into the caval prosthesis. In another patient, right hepatectomy was associated with right diaphramectomy during the same procedure. The median length of stay was 16 days and there were no peri-operative deaths.

Postoperative complications developed in two patients. One patient presented a voluminous hemoperitoneum 7 days after surgery requiring revision for peritoneal lavage: no active bleeding site could be identified and the postoperative period was uneventful. The second complication was a lithiasis leading to acute pancreatitis (Balthazar E) 20 days after surgery, which developed in a patient with a 24-cm right liver compressing sarcoma. The MRI cholangiogram visualized a stone-free common duct and gallbladder. It was hypothesized that the stone had formed within the liver due to the compression of the common bile duct then migrated when the obstacle was removed. A preoperative cholecystogram was unavailable. The course was rapidly favorable. All pathology slides were reassessed by two pathologists. Two patients received adjuvant chemotherapy (25%). One patient received five cycles of doxorubicin-ifosfamide and a second received four cycles of doxorubicin-ifosfamide-mesna-dexrazoxane.

For the eight patients, mean overall survival was 120 months and mean disease-free survival was 19 months. Survival was better for grade I tumors (mean overall survival and disease-free survival 87 and 61 months respectively) than for grade II (41 and 18 months) and grade III tumors (55 and 9 months). Mean 3-year survival rate was 87.5%. One patient with a grade II tumor developed recurrence in the right lung 9 years and 3 months postoperative and underwent right pneumonectomy. One patient with a grade I tumor developed a recurrence 5 years after the initial operation with a hepatic lesion affecting the dome and invading the diaphragm. Secondary R0 surgery was successful. Pathology reported progression to grade II and five months later,