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Direct 64-row MDCT venography in the diagnosis of an inferior vena cava leiomyosarcoma

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Abstract

We report the usefulness of a technique called direct-MDCT venography in the diagnostic workup of a patient with an inferior vena cava leiomyosarcoma. The technique consists in the injection of contrast agent through both lower limbs achieving maximum enhancement in the inferior vena cava. Images are similar to those of the gold standard conventional cavography. To our knowledge, this is the first description of the direct-MDCT imaging appearance of an inferior vena cava leiomyosarcoma.

Key words: Inferior cava vein—MDCT—Venography—Leiomyosarcoma—Cavography

Leiomyosarcoma is the most common primary tumor of the inferior vena cava (IVC) [1]. It most frequently affects women in the 5th and 6th decades of life, involving primarily the two lower thirds of the IVC [2].

It is a mesenchymal tumor that arises from the smooth muscle that lies within the IVC wall. It has a poor prognosis, with a 10 year survival of 14% to 29.5% [3, 4]. Clinical findings are usually nonspecific, such as abdominal pain, right upper quadrant palpable mass, emaciation, or progressive lower limbs edema [5]. It is classified according to its location on the IVC and its relation with the hepatic veins: lower or segment I, located below the renal veins; middle or segment II, located at the same level as renal veins or the retrohepatic IVC; upper or segment III, located at the suprahepatic portion of the IVC [3, 5]. Poor prognostic indicators relate to the cellular grade of the tumor (high), its location (segment III), and presenting symptoms (IVC occlusion or Budd–Chiari syndrome). On the contrary, tumors located on segment II may have a better prognosis [5].

Publications regarding this type of tumor have been primarily through case reports involving small groups of patients [5–7] with few exceptions [4]. While multiple imaging modalities such as computed tomography (CT), ultrasonography (US), and magnetic resonance (MR) have been reported to be helpful for diagnosis, no single imaging modality has been proven to outdo the others.

The aim of this paper is to report a patient with IVC leiomyosarcoma diagnosed with a novel imaging technique called direct-MDCT venography.

Case report

A 77-year-old male was referred with a recent history of abdominal pain and weight loss of 11 lb in a 2-month period. Physical and laboratory examinations were uneventful as well as medical history. A CT scan performed elsewhere showed a retroperitoneal mass that seemed to compromise the IVC.

It was decided, upon referral to our institution, to perform a direct-MDCT venography, for better depiction of the IVC compromise, using a 64-channel multidetector CT (Aquillion®, Toshiba). After bilateral puncture of the pedal veins, simultaneous injection of non ionic iodine contrast medium (Optiray 350®; Covidien, USA) diluted in saline solution (ratio 1:3) was performed at a flow rate of 3 mL/s using two automatic injectors (EmpowerCTA, ACIST medical systems), thus achieving simultaneous filling of both lower limbs deep venous system as well as the IVC. MDCT acquisition was triggered automatically using the software SureStart® (Toshiba) when the contrast material reached 180 HU in the IVC. In order to

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properly stage the patient, images of the thorax and abdomen where also acquired at a portal phase and at excretion phase. Scan parameters were: 0.5 mm slices every 0.3 mm table feed, 50 mAs, 80 kV, 0.75 s rotation time, and 0.875 pitch. Each acquisition lasted an average of 8 s. Once acquired, images were sent to a working station (Vital Image Inc., USA) for volumetric rendering reconstructions and evaluation.

The study showed a well-defined soft tissue mass localized in the retroperitoneal space, originating from the wall of the IVC and compromising its lumen at segment II (Fig. 1). The mass showed extension to the vascular pedicle of the right kidney (Fig. 2). The left renal pedicle was not compromised. Collateral circulation through the lumbar veins was also observed as a consequence of the partial obstruction of the IVC. The imaging findings were interpreted as a possible IVC leiomyosarcoma, prompting the surgical removal of the tumor.

After a right subcostal incision, the peritoneal cavity was inspected to rule out regional carcinomatosis. The greater omentum was displaced along with the abdominal contents in order to dissect the infrahepatic IVC. The tumor was clearly identified extending caudally near the right renal hilum where extension to the vascular pedicle was apparent (Fig. 3). After excluding the compromise of the left renal vein, excision of the right kidney and the compromised portion of the IVC were performed with total venous occlusion. A Goretex® implant was used to reconstruct the IVC and a cadaveric iliac venous graft was used for the anastomosis with the left renal vein. On the ninth day post-surgery he was discharged from the hospital.

Fig. 2. Curved multiplanar reconstruction of the renal veins and ICV showing extension of the tumor to the right renal vein (*arrow*). *RV* right vein, *LV* left vein.

Pathology analysis showed at gross anatomy a white solid tumor, measuring $5 \times 4.5 \times 3.5$ cm, in contact with the IVC wall occupying the totality of the lumen and extending into the right renal vein. Histological analysis showed tumor proliferation of spindle cells, constituted by atypical cells with hyperchromatic, pleomorphic, and tapered nuclei (Fig. 4). Some cells presented with multiple nuclei with atypical mitosis of up to 7–8 per 10 high power field which categorizes the mass as a high grade cellular tumor. Upon closer examination infiltration of the smooth muscle of the venous wall was evidenced. The pathology report concluded the tumor was a high cellular grade leiomyosarcoma of the IVC.

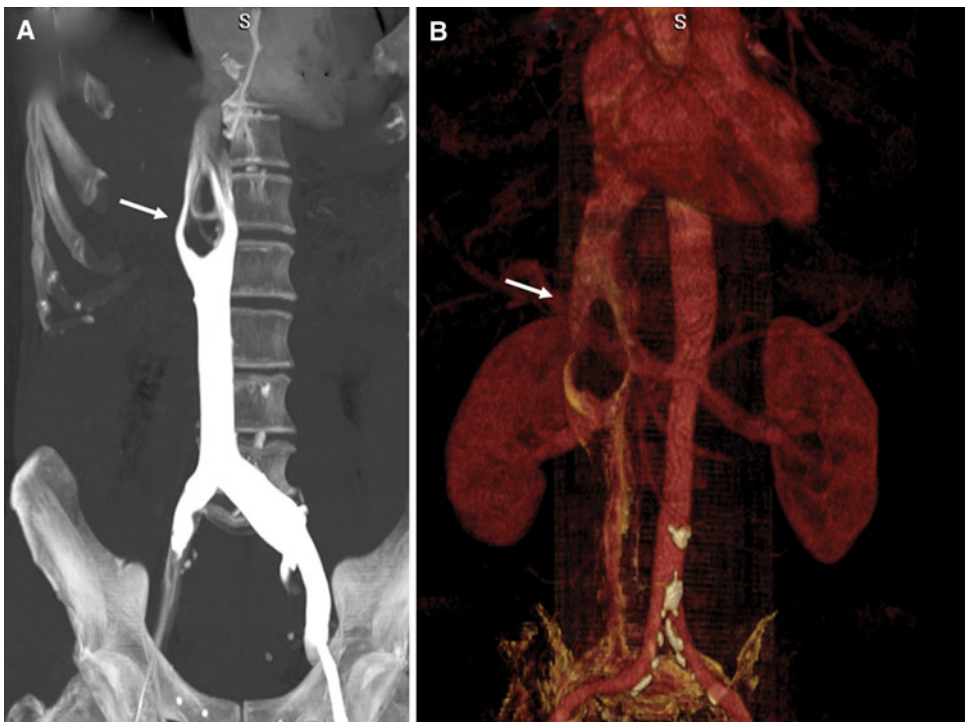

Fig. 1. Coronal reconstruction in maximum intensity (**A**) and volume rendering (**B**) of the entire ICV showing a filling defect at level II (*arrow*).

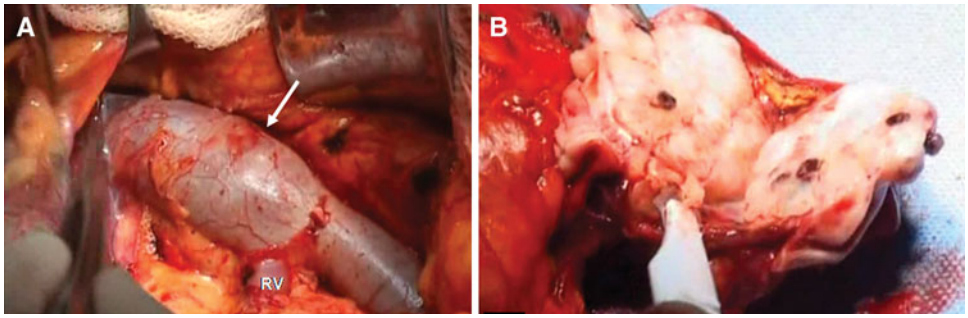

Fig. 3. Surgical correlation. **A** Thickened segment II of the IVC (*white arrow*) and right kidney vein (*RV*). **B** Open surgical specimen.

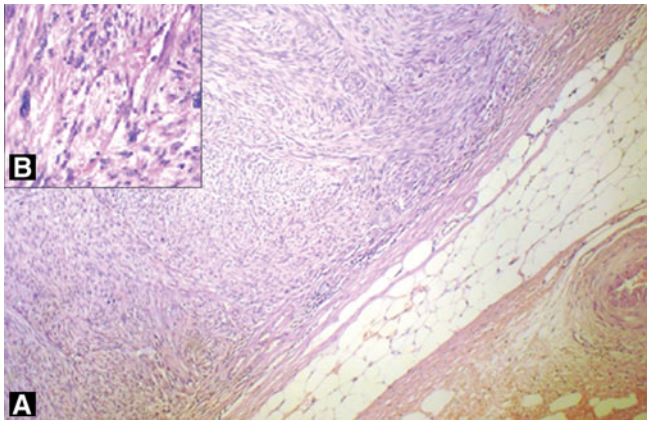

Fig. 4. **A** 4×/0.10 high power field of the vascular wall where infiltration of the smooth muscle layer by the mesenchymal tumor is seen. There is no evident infiltration of the fatty tissue. **B** 40×/0.10 high power field of the tumor where the hyperchromatic, pleomorphic, and tapered nuclei of the tumorous cells are evident.

Two months after surgery, a follow up indirect-MDCT venography confirmed the patency of the venous graft and minimal inflammatory changes at the surgical field.

The patient remains symptom free and with an uneventful follow up at 10 months of surgery.

Discussion

Historically, IVC leiomyosarcoma was an autopsy finding. Nowadays with state of the art imaging procedures, IVC leiomyosarcomas are more easily detectable and therefore patients have a better chance of survival. Imaging techniques such as US, MR, CT, MDCT have been used to diagnose this disease.

In this particular case we favored the use of direct-MDCT venography because of its multiple advantages when diagnosing and staging a retroperitoneal mass that compromises the IVC over the other diagnostic methods. MDCT can exquisitely depict pathologic conditions affecting the IVC as a consequence of its superior spatial resolution, very fast image acquisition and detailed evaluation of adjacent and distant organs with one single imaging technique. Isotropic data acquisition allows excellent resolution in any plane, which is essential not only for diagnosis but also for surgical planning [8, 9]. MDCT of the IVC has usually been performed in an indirect way by injecting the contrast material via an antecubital vein and scanning the abdomen with a 70–90 s delay [3, 10]. However, the amount of contrast enhancement reached in the venous system can be insufficient, while with the direct technique the enhancement should always be optimal and the images similar to those of conventional cavography, considered by some the gold standard when studying the IVC and another way to study tumors involving the IVC [11, 12]. Also direct-MDCT venography yields comprehensive anatomic information, leading to avoidance of anatomic pitfalls and increasing confidence in the surgical approach. In addition, the required volume of contrast agent for a satisfactory study is less compared to the required volume in an indirect CT or in a conventional cavography.

This technique has also proven useful in the evaluation of Klippel–Trénaunay syndrome and in the evaluation of Budd-Chiari syndrome [13, 14]. In our institution it is the study of choice when in need of detailed analysis of the venous system of the inferior limbs (deep vein thrombosis, May–Thurner syndrome, etc.) or when studying pathological conditions of the IVC (tumoral spread, IVC agenesis, etc.).

CT main drawbacks are radiation exposure and the use of a contrast agent. However, some authors agree that the benefits of this examination far outweigh its risks, regarded a proper indication [15].

It can be argued that MR and US lack the use of ionizing radiation, but they do not yield the same spatial resolution as CT. It can also be argued that the use of a contrast agent is not a requirement for an US, but this benefit is diminished by other limitations, such as operator dependency and difficulty analyzing obese patients or when there is air interposition.

Neither US nor MR nor conventional cavography were considered necessary in our patient, since direct-MDCT venography provided all the information needed for diagnosis and treatment decision.

In conclusion, when in need of detailed information of IVC anatomy (including tributary and collateral

veins), retroperitoneal tumor characteristics, location and relationship to adjacent organs as well as abdominal staging with a sole examination technique, direct-MDCT venography may be considered.

References

1. Cacoub P, Piette JC, Wechsler B, et al. (1991) Leiomyosarcoma of the inferior vena cava. Experience with 7 patients and literature review. Medicine 70:293–306
2. Hartman DS, Hayes WS, Choyke PL, Tibbetts GP (1992) From the archives of the AFIP. Leiomyosarcoma of the retroperitoneum and inferior vena cava: radiologic-pathologic correlation. Radiographics 12:1203–1220
3. Sheth S, Fishman EK (2007) Imaging of the inferior vena cava with MDCT. AJR 189:1243–1251
4. Mingoli A, Cavallaro A, Sapienza P, et al. (1996) International registry of inferior vena cava leiomyosarcoma: analysis of a world series on 218 patients. Anticancer Res 16:3201–3205
5. Abisi S, Morris-Stiff GJ, Scott-Coombes D, et al. (2006) Leiomyosarcoma of the inferior vena cava: clinical experience with four cases. World J Surg Oncol 4:1
6. Delis S, Triantopoulou C, Bakoyiannis A, Tassopoulos N, Dervenis C (2008) Leiomyosarcoma of the infrarenal portion of the inferior vena cava in a cirrhotic patient with hepatitis C. Abdom Imaging 33:222–224
7. Narata M, Okuhata Y, Abe K, Takemoto A, Maebayashi T, Furuhashi S, Takahashi M (2009) Primary leiomyosarcoma of the inferior vena cava: case report. Abdom Imaging, Springerlink 1432–0509, June 26
8. Mahesh M (2002) Search for isotropic resolution in CT from conventional through multiple-row detector. Radiographics 22:949–962
9. Hara AK, Johnson CD, MacCarty RL, et al. (2001) CT colonography: single- versus multi-detector row imaging. Radiology 219:461–465
10. Zhang L, Yang G, Shen W, Qi J (2007) Spectrum of the inferior vena cava: MDCT findings. Abdom Imaging 32:495–503
11. Bonamigo TP, Becker M, Faccini FP, et al. (2003) Leiomyosarcoma of the inferior vena cava—a case report. Vasc Endovascular Surg 37:225–228
12. Gowda RM, Gowda MR, Mehta NJ, et al. (2004) Right atrial extension of primary venous leiomyosarcoma: pulmonary embolism and Budd-Chiari syndrome at presentation-a case report. Angiology 55:213–216
13. Mavili E, Ozturk M, Akcali Y, et al. (2009) Direct CT venography for evaluation of the lower extremity venous anomalies of Klippel-Trenaunay Syndrome. AJR Am J Roentgenol 192:311–316
14. Virmani V, Khandelwal N, Kang M, Gulati M, Chawla Y (2009) MDCT venography in the evaluation of inferior vena cava in Budd-Chiari syndrome. Indian J Gastroenterol 28:17–23
15. McCollough CH, Bruesewitz MR, Kofler JMJr (2006) CT dose reduction and dose management tools: overview of available options. Radiographics 26:503–512