Valoarea CT şi IRM în diagnosticul trombusului tumoral în carcinomul renal cu celule clare*

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Abstract

Introduction. Renal cell carcinoma (RCC) often invades the renal vein and may extend into the inferior vena cava or right atrium [1]. The purpose of this study was to evaluate the diagnostic capabilities of magnetic resonance imaging (MRI) and computed tomography (CT) in patients with venous invasion RCC and correlated the results with histopathological and intraoperative findings.

Materials and Methods. 28 patients were diagnosed with RCC with venous tumor thrombus in the period from January 2009 to December 2009. Before their operation, four patients had contrast enhanced CT, three patients had contrast enhanced MRI and 21 patients were assessed for suspected venous extension of RCC with both methods. Images obtained by both techniques were assessed for the presence of tumour thrombus, its level (including any extension into the contralateral renal vein or hepatic veins), vessel wall adherence or invasion, and local tumour staging (lymph node metastases, capsular penetration, contiguous organ involvement). All images were analyzed by experienced radiologists. One pathologist reported all pathology specimens and the superior extent of tumor thrombus were confirmed by the surgeon at each operation. CT and MRI results were compared with surgical and pathological findings.

Results. 17 patients (60.7%) had RCC on the right side and 11patients (39.3%) on the left side. According to Novick classification, clinical and histopathological findings, 15 patients (53.5%) are in group A tumor thrombus, seven patients (25%) group B, four patients (14.2%) group C and two patients (7.1%) group D. CT accurately diagnosed the upper extent of the tumour thrombus in 23 cases (92%). MRI accurately predicted the upper extent of the thrombus in all cases. Seven patients had metastatic involvement of regional lymph nodes. Pulmonary metastases were seen in three cases.

Conclusions. CT and MRI are common imaging methods in diagnosing the superior extent of tumor thrombus in renal cell carcinoma. With the development of Multidetector CT, its accuracy in defining tumor thrombus in RCC is comparable to MRI.

Key words: renal cell carcinoma, venous thrombosis, multidetector CT, MRI

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Introduction

Renal cell carcinoma (RCC) is the commonest solid lesion within the kidney and accounts for 85 to 90% of all kidney malignancies [2]. As an indication of its biological aggressiveness, RCC often invades the renal vein at the hilum and may extend along it into the inferior vena cava. A tumour thrombus with extension into the renal vein or the inferior vena cava (IVC) is diagnosed in 4-10% of all renal cell carcinomas [3]. Further extension is usually superiorly with the flow of blood, occasionally as far as the right atrium. Sometimes tumour extends into the contralateral renal vein. Interestingly it is almost intraluminal tumor, the inferior vena cava wall itself being rarely invaded. The disturbance of blood flow in the inferior vena cava may lead to thrombus formation and pulmonary emboli [4]. The extension of the tumor thrombus affects the surgical approach. It is important to assess extension into the contralateral renal vein and the superior limit of inferior vena cava involvement. Patients with an extension of the tumor thrombus to the level of the hepatic veins or right atrium must undergo extensive surgery using a cardiopulmonary bypass and require the involvement of a cardiac surgery team.

The purpose of the present study was to evaluate the diagnostic capabilities of magnetic resonance imaging (MRI) and computed tomography (CT) in patients with venous invasion RCC by correlating the imaging results with histopathological and intraoperative findings.

Materials and Methods

This retrospective study was performed on 28 patients (22 males and 6 female; age range 41 years to 83 years; mean age 59.8) diagnosed with RCC with venous tumor thrombus in the period from January 2009 to December 2009. Diagnostic procedures performed included a multidetector CT with 3D reconstruction and an MR scan according to our protocol. Before their operation, four patients had contrast enhanced CT, three patients had contrast enhanced MRI and 21 patients were assessed for suspected venous extension of RCC with both methods. Images obtained by both techniques were assessed for the presence of tumor thrombus, its level (including any extension into the contralateral renal vein or hepatic veins), vessel wall adherence or invasion, and local tumor staging (lymph node metastases, capsular penetration, contiguous organ involvement). The superior extent of the tumor thrombus was assessed as follows: infrahepatic, intrahepatic (below the hepatic veins), infradiaphragmatic (at or above the hepatic veins), supradiaphragmatic, or atrial. All images were analyzed by experienced radiologists. All surgery was performed within one week after cross-sectional imaging diagnosis. One pathologist reported all pathology specimens and the superior extent of tumor thrombus were confirmed by the surgeon at each operation. CT and MRI results were compared with surgical and pathological findings.

Patients were staged according to 2002 TNM classification and the superior extent of tumour thrombus was defined according to Novick classification [5]. The patients were divided into four groups according to the level of their tumour thrombus extension:

- Group A thrombus extending < 2 cm above the renal vein
- Group B thrombus extending > 2 cm above the renal vein, but below the level of the insertion of the hepatic veins
- Group C extension of the caval thrombus within the level of the intrahepatic vena cava
- Group D tumour thrombus extending above the diaphragm or within the right atrium.

Results

17 patients (60.7%) had RCC on the right side and 11patients (39.2%) on the left side.

All patients had radical nephrectomy and tumour thrombus excision.

According to Novick classification, intraoperative and histopathological findings revealed:

- Group A 15 patients (53.5%)
- Group B 7 patients (25%)
- Group C 4 patients (14.2%)
- Group D 2 patients (7.1%).

Seven patients had metastatic involvement of regional lymph nodes. Pulmonary metastasis were seen in three cases. CT accurately diagnosed the upper extent of the tumor thrombus in 23 cases (92%). MRI accurately predicted the upper extent of the thrombus in all cases. The thrombi not detected by CT were small and non-obstructing.

Discussion

RCC has a predilection to invade the renal vein and may extend into the inferior vena cava or right atrium. Of patients undergoing radical nephrectomy for RCC,

4-10% has IVC involvement. In these extended tumors, surgical resection remains the only chance for a cure. Optimal surgical planning requires accurate knowledge of the cephalic extent of the tumor thrombus.

The 5-year survival rate for RCC when completely resecting an IVC tumour thrombus in patients with no metastases is 30-69%. The long term survival rate does not depend on the level of thrombus, but on local tumor extension, regional nodal involvement and the presence of metastatic disease [1].

RCC on the right side is more likely to extend into the IVC because of the shorter vein, and because the left renal vein crosses the pulsatile aorta (1).

In the past, venacavography was the "gold standard" for detecting and evaluating tumor thrombi. Since the development of new imaging methods, CT and MRI, venacavography is used less. In addition to venacavography, MR and CT imaging provide complete staging of the abdomen including lymph node staging and locoregional invasion.

MRI has been reported to have a sensitivity of up to 100% in detecting IVC thrombi [2]. MRI proved to be superior to spiral CT for thrombus detection and has replaced venacavography as the gold standard [2]. It has the advantages of being noninvasive, delivers no radiation to the patient and gives information in any of the three orthogonal anatomical planes. The MR has intrinsic contrast superiority to CT and does not need to rely on contrast medium to differentiate tumor thrombus from blood. MRI may also sometimes delineate blood clots from tumor thrombus. Such knowledge cannot be gained from other imaging techniques.

For imaging extensive RCC enhanced 3D MR angiography has been used. Further developments will result in even greater imaging capabilities of MRI, but access and cost remain strong impediments to its widespread use.

With the introduction of multidetector CT (MDCT) it is possible to employ high-quality three-dimensional datasets of the renal vessels, comparable with angiography and conventional urography. CT has the disadvantage of being depended on contrast medium inflow to diagnose a tumor thrombus. Several studies compared MDCT with MRI. Hallscheidt et al. [6,7] reported accuracy of MDCT in delineation of the superior extent of the thrombus with a sensitivity of 93% and specificity of 80%. It was similar to MRI. A study by Lawrentschuk [1] et al showed the accuracy of MDCT in detection of the superior extent of tumor thrombus. In that study, MRI understaged one case. In our study, CT detected the correct superior extent of tumor thrombus in 23of 25 patients and MRI 24/24.

Conclusions

CT and MRI are common imaging methods in diagnosing the superior extent of tumor thrombus in renal cell carcinoma.

With the development of MDCT, its accuracy in defining tumor thrombus in RCC is comparable to MRI.

No imaging method is always completely accurate, and even "gold standards" of imaging may be incorrect.

References

1. Lawrentschuk N, Gani J, Riordan R et al. *Multidetector computed tomography vs magnetic resonance imaging for defining the upper limit of tumour thrombus in renal cell carcinoma: a study and review.* BJU Int. 2005 Aug;96(3):291-5. Review.PMID: 16042716 [PubMed - indexed for MEDLINE]
2. Guo HF, Song Y, Na YQ. *Value of abdominal ultrasound scan, CT and MRI for diagnosing inferior vena cava tumour thrombus in renal cell carcinoma.* Chin Med J (Engl). 2009 Oct 5;122(19):2299-302.PMID: 20079129 [PubMed - indexed for MEDLINE]
3. Hallscheidt PJ, Fink C, Haferkamp A et al. *Preoperative staging of renal cell carcinoma with inferior vena cava thrombus using multidetector CT and MRI: prospective study with histopathological correlation.* J Comput Assist Tomogr. 2005 Jan-Feb; 29(1):64-8.PMID:15665685 [PubMed - indexed for MEDLINE]
4. Sutton D. *Textbook of Radiology and Imaging,* seventh edition, Churrchill Livingstone, 2003.
5. Sinescu I, Gluck G, *Tratat de Urologie,* editia I-a, Editura Medicală, 2008
6. Hallscheidt PJ, Fink C, Haferkamp A et al. *Preoperative staging of renal cell carcinoma with inferior vena cava thrombus using multidetector CT and MRI: prospective study with histopathological correlation.* J Comput Assist Tomogr. 2005 Jan-Feb;29(1):64-8.PMID: 15665685 [PubMed - indexed for MEDLINE]
7. Hallscheidt PJ, Bock M, Riedasch G et al. *Diagnostic accuracy of staging renal cell carcinomas using multidetector-row computed tomography and magnetic resonance imaging: a prospective study with histopathologic correlation.* J Comput Assist Tomogr. 2004 May-Jun;28(3):333-9.PMID: 15100536 [PubMed - indexed for MEDLINE]

Rezumat

Introducere. Carcinomul cu celule clare (RCC) invadează adesea vena renală şi se poate extinde în vena cavă inferioară sau în atriul drept [1]. Scopul acestui studiu a fost de a evalua capacităţile diagnostice ale imagisticii prin rezonanţă magnetică (IRM) şi ale tomografiei computerizate (CT) la pacienţii cu RCC şi extensie venoasă tumorală şi corelarea acestora cu rezultatele histopatologice şi intraoperatorii.

Materiale şi metode. 28 pacienţi au fost diagnosticaţi cu RCC şi tromboză tumorală venoasă, în perioada cuprinsă între ianuarie 2009 şi decembrie 2009. Preoperator, patru pacienţi au efectuat CT cu substanţă de contrast, trei pacienţi au efectuat IRM cu substanţă de contrast şi 21 pacienţi au beneficiat de ambele metode imagistice. Imaginile obţinute prin ambele tehnici au fost evaluate pentru identificarea prezenţei trombusului tumoral, precizarea localizării sale (inclusiv extensia în vena renală contralaterală sau în venele hepatice), aderarea de peretele vascular sau invazia acestuia şi stadializarea tumorii. Toate examinările CT şi RM au fost analizate de către medici radiologi cu experienţă. Un medic anatomopatolog a raportat toate specimenele patologice. Nivelul superior al trombusului tumoral a fost confirmat de către chirurgul urolog la fiecare intervenţie chirurgicală. Rezultatele CT şi IRM au fost comparate cu cele chirurgicale şi anatomopatologice.

Rezultate. 17 pacienţi (60,7%) au avut RCC pe partea dreaptă şi 11 pacienţi (39,2%), pe partea stângă. Rezultatele clinice şi histopatologice, conform clasificării Novick, clasifica lotul studiat după cum urmează: 15 pacienţi (53,5%) în grupul A , 7 pacienţi (25%) în grupul B, 4 pacien_i (14,2%), în grupul C ºi 2 pacien_i (7,1%) în grupul D. CT a diagnosticat cu precizie nivelul superior al trombusului tumoral în 23 cazuri (92%). IRM a precizat cu exactitate extremitatea superioară a trombusului în toate cazurile. Sapte pacien_i a avut adenopatii loco-regionale. Metastaze pulmonare a fost observate în trei cazuri.

Concluzii. CT şi IRM sunt examinări imagistice de referinţă în aprecierea nivelului superior al trombusului tumoral în carcinomul renal cu celule clare (RCC). Odată cu dezvoltarea CT multidetector, acurateţea acestuia în diagnosticarea trombusului tumoral în carcinomul renal cu celule clare este similară imagisticii prin RM.

Cuvinte cheie: carcinomul cu celule clare, tromboză venoasă, multidetector CT, RMN