Tumour-to-tumour metastases: prostate carcinoma metastasising to a renal oncocytoma

Gemma Petts,¹ Tina Rashid,² David Hrouda,² Nye-Thane Ngo¹

¹Department of Cellular Pathology, Imperial College Healthcare NHS Trust, London, UK

²Department of Urology, Imperial College Healthcare NHS Trust, London, UK

Correspondence to
Nye-Thane Ngo,
n.ngo@imperial.ac.uk

SUMMARY

This is a case report of prostate carcinoma metastasising to a renal oncocytoma. The report demonstrates the unusual presentation of metastases from a common cancer to a common benign tumour, and reviews the rare phenomenon of tumour-to-tumour metastases.

BACKGROUND

Tumour-to-tumour metastases are rare but the histopathologist should be aware of this phenomenon in order to correctly identify morphologically divergent areas within a tumour and keep an open mind to the possibility of this phenomenon especially when there is a history of concurrent or previous malignancies.

For both the clinician and the histopathologist this phenomenon highlights the need for comprehensive history taking and good communication of this information between disciplines.

CASE PRESENTATION

A 74-year-old man was found to have a left upper pole renal mass on ultrasound scan while being investigated for an episode of asymptomatic haematuria. His significant medical history included metastatic prostate carcinoma (bone involvement only) that was under hormonal control with diethylstilboestrol (prostate specific antigen (PSA) 23.99 ng/ml).

INVESTIGATIONS

A contrast-enhanced CT scan confirmed the presence of an exophytic mass with central necrosis arising from the anterior aspect of the mid-portion of the left kidney. Radical nephrectomy was performed.

Examination of the fixed organ showed a mid-zone well-circumscribed tumour measuring 7.2 cm in maximum dimension. The tumour had a brown homogeneous appearance. An area of central scarring was identified but no necrosis was seen (contrary to the CT scan). Three hilar lymph nodes were identified and sampled.

Microscopic examination revealed a well-circumscribed unencapsulated tumour composed of nests, sheets, acini and tubules of uniform round to polygonal cells with central, round regular nuclei, small nucleoli and eosinophilic granular cytoplasm. No nuclear atypia, mitoses or necrosis was seen. The central scar-like area was composed of paucicellular, oedematous stroma. There was no central necrosis. The lesion merged with the adjacent surrounding normal renal parenchyma. There was bulging of the tumour into the surrounding perinephric fat.

Immunohistochemistry showed the lesion to be diffusely positive for E-cadherin and CK8/18 with patchy positivity for epithelial membrane antigen (EMA), CD117, CD15, CK7 and vimentin. The tumour was negative for CK20, PSA, renal cell carcinoma (RCC) Ag and CD10 and the proliferation index, as estimated by Ki67, was low (<2%). The morphological features were consistent with a renal oncocytoma.

In addition, there were multiple microscopic foci admixed with the main lesion that showed acini and fused, cribriform glands composed of markedly atypical cells which appeared morphologically different from the main lesion. Immunohistochemistry showed these foci to be diffusely positive for CK8/18, PSA and E-cadherin, patchy positivity for CD15 and scattered cells positive for EMA and CK7. These tumour cells were negative for CD117, CK20, RCC Ag and CD10. These tumour cells were also found within lymphovascular spaces within the kidney, in two of three hilar lymph nodes (with extracapsular spread) and as a separate nodular deposit in extranodal fat.

OUTCOME AND FOLLOW-UP

The morphological features and immunohistochemical profile was of foci of metastatic prostate adenocarcinoma within the parenchyma of the renal oncocytoma (figure 1), with further metastatic deposits in renal vasculature and hilar lymph nodes (figure 2).

DISCUSSION

Tumour-to-tumour metastasis is a rare phenomenon and should be separated from collision tumours (which describes where two primary, originally separate and histologically distinct tumours merge).

The definition of tumour-to-tumour metastasis was set out by Campbell *et al*¹ in 1968 and the criteria are

- ▶ More than one primary tumour must exist in the patient.
- ▶ The recipient tumour should be a true benign or malignant neoplasm.
- ▶ The metastatic neoplasm should be a true metastasis with established growth in the host tumour, not the result of contiguous growth ('collision tumour') or embolisation of tumour cells within the vessels.
- ▶ Tumours that have metastasised to the lymphatic system, where lymphoreticular malignant tumours already exist are excluded.

From the literature, the most common recipient is renal cell carcinoma and the most common donor tumour is pulmonary carcinoma.² A search

To cite: Petts G, Rashid T, Hrouda D, *et al*. *BMJ Case Reports* Published online: [please include Day Month Year] doi:10.1136/bcr-2012-007366

Figure 1 Renal oncocytoma with focus on metastatic prostate carcinoma. (A) H&E, (B) PSA, (C) Ki67 proliferation marker (all $\times 100$ magnification). PSA, prostate specific antigen.

of Pubmed revealed 114 case reports or case series of tumour-to-tumour metastases (table 1).

Prostate carcinoma typically metastasises to the bone, and, in the setting of tumour-to-tumour metastasis, only seven case reports have been published where prostate adenocarcinoma was the donor tumour.

The mechanism of tumour-to-tumour metastases is not fully understood but it is hypothesised that highly vascular tumours could receive a large proportion of embolism by another tumour making them likely recipient tumours.² The kidney is a highly vascular organ and many of the renal parenchymal

tumours also show prominent vascularisation suggesting that this vascular theory is the probable explanation for the predominance of recipient renal parenchymal tumours in the tumour-to-tumour literature.

The identification of tumour-to-tumour metastases is dependent on the recognition of morphologically divergent areas within a tumour and the selection of appropriate immunohistochemical antibodies for identification of tumour islands of a separate origin. The histopathologist must keep an open mind to the possibility of tumour-to-tumour metastases especially when there is a history of concurrent or previous malignancies.

Figure 2 Lymph node containing deposit of metastatic prostate carcinoma. (A) H&E, (B) PSA (all $\times 100$ magnification). PSA, prostate specific antigen.

Table 1 Although renal cell carcinoma is a common recipient neoplasm of a wide variety of metastatic carcinomas, benign renal neoplasms are far less commonly affected with only five cases of metastases to a renal oncocytoma

Recipient neoplasm	Donor neoplasm	Author, year
Renal cell carcinoma and tubular adenoma	Prostate adenocarcinoma	Majmudar, 1976 ³
Renal cell carcinoma	Pulmonary adenocarcinoma	Shuangshoti, 1983 ⁴
Renal cell carcinoma	Malignant melanoma	Singh <i>et al</i> , 1984 ⁵
Renal cell carcinoma	3 separate cases	Sella, 1987 ⁶
Renal cell carcinoma	Prostate adenocarcinoma	Tislavicz, 1991 ⁷
Renal cell carcinoma	Prostate adenocarcinoma	Inatomi <i>et al</i> , 1996 ⁸
Renal cell carcinoma	2 cases: Bronchial carcinoma	Sperb <i>et al</i> , 1996 ⁹
Renal cell carcinoma	Basaloid squamous cell carcinoma of the tonsil	Khurana, 1997 ¹⁰
Renal cell carcinoma	Cervical carcinoma	Petraki <i>et al</i> , 2003 ¹¹
Renal cell carcinoma	Pulmonary adenocarcinoma	Granville <i>et al</i> , 2005 ¹²
Renal Cell Carcinoma	Pulmonary carcinoma	Sawada <i>et al</i> , 2009 ¹³
Renal cell carcinoma	Neuroendocrine carcinoma	Duprez <i>et al</i> , 2009 ¹⁴
Renal cell carcinoma	Gastric signet ring adenocarcinoma	Sakai <i>et al</i> , 2010 ¹⁵
Renal cell carcinoma	Malignant melanoma (amelanotic)	Sayk <i>et al</i> , 2010 ¹⁶
Chromophobe Renal cell carcinoma	Colorectal adenocarcinoma	Shin <i>et al</i> , 2011 ¹⁷
Renal cell carcinoma	Pulmonary adenocarcinoma	Aggarwal <i>et al</i> , 2012 ²
Renal angiomyolipoma	2 cases: Neuroendocrine carcinoma of the pancreas and pulmonary adenocarcinoma	Ricketts <i>et al</i> , 2008 ¹⁸
Renal adenoma	Pulmonary squamous cell carcinoma	Popov <i>et al</i> , 2001 ¹⁹
Renal oncocytoma	Bronchogenic carcinoma	Olsen <i>et al</i> , 1984 ²⁰
Renal oncocytoma	Pulmonary squamous cell carcinoma	Altinok <i>et al</i> , 1999 ²¹
Renal oncocytoma	Breast carcinoma	Gassler <i>et al</i> , 2006 ²²
Renal oncocytoma	Breast carcinoma	Fox <i>et al</i> , 2009 ²³
Renal Oncocytoma	Prostate adenocarcinoma	*Horn <i>et al</i> , 2010 ²⁴
Meningioma	Prostate adenocarcinoma	Bernstein <i>et al</i> , 1983 ²⁵
Pituitary adenoma	Prostate adenocarcinoma	Ramsay <i>et al</i> , 1988 ²⁶
Follicular adenoma	Prostate adenocarcinoma	Ro <i>et al</i> , 1994 ²⁷
Meningioma	Prostate adenocarcinoma	Mitchell <i>et al</i> , 2011 ²⁸

Case reports, renal recipient neoplasm or prostate adenocarcinoma donor.

*Unpublished, poster presentation at College of American Pathologists 2010 Meeting.

This case report demonstrates a case of metastatic prostate adenocarcinoma to a renal oncocytoma and highlights this rare phenomenon. Given the propensity for tumour-to-tumour metastases to occur in renal tumours, it is advisable that urological histopathologists and urologists are aware of the phenomenon so that an adequate clinical history of malignancies can be provided that could guide the histopathologist to the diagnosis, should they encounter a renal tumour with atypical morphology.

Learning points

- Tumour-to-tumour metastases are a rare phenomenon but should be considered when there are morphologically divergent areas within a tumour and there is a history of concurrent or previous malignancies.
- Tumour-to-tumour metastases are not collision tumours and are defined by Campbell's four criteria.
- Current theories of the mechanism of tumour-to-tumour metastases centre on the vascularity of recipient tumours and their ability to receive a significant load of tumour emboli.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- Campbell LV Jr, Gilbert E, Chamberlain CR Jr, *et al*. Metastases of cancer to cancer. *Cancer* 1968;22:635–43.
- Aggarwal N, Aminb RM, Chung D, *et al*. Tumor-to-tumor metastasis: case report of a pulmonary adenocarcinoma metastatic to a clear cell renal cell carcinoma. *Pathol Res Pract* 2012;208:50–2.
- Majmudar B. Metastasis of cancer to cancer: report of a case. *Hum Pathol* 1976;7:117–19.
- Shuangshoti S. Metastasis of bronchogenic adenocarcinoma to renal adenocarcinoma. *South Med J* 1983;76:791–4.
- Singh EO, Benson RC Jr, Wold LE. Cancer-to-cancer metastasis. *J Urol* 1984;132:340–2.
- Sella A, Ro JY. Renal cell cancer: best recipient of tumor-to-tumor metastasis. *Urology* 1987;30:35–8.
- Tislavicz L, Krenács T, Rózsa Z. Prostatic cancer metastasized into the kidney and kidney cancer metastasized into the lung. *Orv Hetil* 1991;132:1539–42.
- Inatomi H, Yamada Y, Okamura T. A case of prostate carcinoma metastasizing to renal cell carcinoma. *Int J Urol* 1996;3:155–7.
- Sperb RA, Arnold W, Gebbers JO. Carcinoma-in-carcinoma metastasis. In situ DNA quantification and immunohistochemical diagnosis. *Pathologe* 1996;17:385–90.
- Khurana KK, Powers CN. Basaloid squamous carcinoma metastatic to renal-cell carcinoma: fine-needle aspiration cytology of tumor-to-tumor metastasis. *Diagn Cytopathol* 1997;17:379–82.
- Petraki C, Vaslamatzis M, Argyrakos T, *et al*. Tumor to tumor metastasis: report of two cases and review of the literature. *Int J Surg Pathol* 2003;11:127–35.
- Granville LA, Ostrowski ML, Truong LD, *et al*. Pathologic quiz case: unusual morphology in an otherwise classic renal cell carcinoma. Tumor-to-tumor metastasis: pulmonary adenocarcinoma metastatic to clear cell renal cell carcinoma. *Arch Pathol Lab Med* 2005;129:e49–50.
- Sawada T, Takahashi H, Hasatani K, *et al*. Tumor-to-tumor metastasis: report of an autopsy case of lung adenocarcinoma metastasizing to renal cell carcinoma. *Intern Med* 2009;48:1525–9.
- Duprez R, Thimon S, Kerdraon R, *et al*. Tumor-to-tumor metastasis: report of three cases. *Ann Pathol* 2009;29:507–11.
- Sakai Y, Kanomata N, Itami H, *et al*. Signet-ring cell carcinoma of the stomach metastasizing to renal cell carcinoma: a case report and review of the literature. *Kobe J Med Sci* 2010;55:E122–31.
- Sayk F, Mahnen A, Stellmacher F, *et al*. Cancer-to-cancer metastasis: amelanotic melanoma into renal cell carcinoma. *Dtsch Med Wochenschr* 2010;135:507–10.
- Shin T, Kan T, Sato F, *et al*. Tumor-to-tumor metastasis to chromophobe renal cell carcinoma: A first report. *Case Rep Urol* 2011;2011:520839.
- Ricketts R, Tamboli P, Czerniak B, *et al*. Tumor-to-tumor metastasis: report of 2 cases of metastatic carcinoma to angiomyolipoma of the kidney. *Arch Pathol Lab Med* 2008;132:1016–20.
- Popov MS, Pugachev KK, Kuz'min IV. Lung carcinoma metastasis in renal adenoma: immunohistochemical study. *Arkiv Patol* 2001;63:37–40.

- 20 Olsen JH, Nielsen OS, Engel U. Neoplasm to neoplasm metastasis. A renal oncocytoma with metastatic bronchogenic carcinoma. *Scand J Urol Nephrol* 1984;18:255–6.
- 21 Altinok G, Güler G, Sahin A. Tumor metastasis to an oncocytoma. *Scand J Urol Nephrol* 1999;33:416–17.
- 22 Gassler N, Haferkamp A, Flechtenmacher C, et al. Renal oncocytoma with metastasis from breast carcinoma: a contribution to the differential diagnosis of tumorous lesions of the kidney. *Pathologe* 2006;27:217–21.
- 23 Fox JJ, Rohan S, Pandit-Taskar N. Breast carcinoma metastatic to renal oncocytoma detected on F-18-FDG PET/CT. *Clin Nucl Med* 2009;34:294–5.
- 24 Horn AJ, Fritz BE, LaGrange CA, et al. Unpublished, poster presentation at College of American Pathologists 2010 Meeting
- 25 Bernstein RA, Grumet KA, Wetzel N. Metastasis of prostatic carcinoma to intracranial meningioma. Case report. *J Neurosurg* 1983;58:774–7.
- 26 Ramsay JA, Kovacs K, Scheithauer BW, et al. Metastatic carcinoma to pituitary adenomas: a report of two cases. *Exp Clin Endocrinol* 1988;92:69–76.
- 27 Ro JY, Guerrieri C, El-Naggar AK, et al. Carcinomas metastatic to follicular adenomas of the thyroid gland. Report of two cases. *Arch Pathol Lab Med* 1994;118:551–6.
- 28 Mitchell RA, Dimou J, Tsui A, et al. Metastatic prostate adenocarcinoma invading an atypical meningioma. *J Clin Neurosci* 2011;18:1723–5.

Copyright 2013 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- Submit as many cases as you like
- Enjoy fast sympathetic peer review and rapid publication of accepted articles
- Access all the published articles
- Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow