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Case Report

A rare case of urachal mucinous adenocarcinoma detected by ¹⁸F-FDG PET/CT and MRI ☆☆☆

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ABSTRACT

Urachal adenocarcinomas are rare cancers of the urinary bladder. Both CT and MRI are useful imaging modalities for the diagnosis and evaluation of urachal adenocarcinoma. Unlike CT or MR, there have been variable FDG PET findings with urachal tumours potentially due to considerable variation in their hypermetabolism. We present the case of a 24 year-old female patient who was diagnosed with urachal mucinous adenocarcinoma with characteristic features on CT and MRI which also exhibit moderately increased FDG avidity.

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Background

The urachus, or otherwise known as the median umbilical ligament, is a remnant of two embryonic structures: the cloaca and allantois [1]. Malignant urachal neoplasms can arise from urachal remnant but are rare and represent less than 0.5% of all bladder tumours with adenocarcinoma be-

ing the most common histological type [1–3]. These tumours are usually asymptomatic due to their extraperitoneal location, and are usually diagnosed at advanced stages with local invasion and/or metastasis [1,4]. To help illustrate ¹⁸F FDG PET imaging findings in urachal adenocarcinomas in conjunction with CT and MRI, we present the case of a 24 year-old female patient who was diagnosed with urachal mucinous adenocarcinoma.

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Fig. 1 – Longitudinal view of the bladder on ultrasound showed a midline mixed echogenic mass with central calcific focus at the dome of the bladder.

Case presentation

An otherwise healthy 24 year-old female patient presented with intermittent dysuria, urgency and macrohaematuria. Urine analysis revealed significant pyuria and haematuria ($>100 \times 10^6/L$ leucocytes and erythrocytes (normal $<10 \times 10^6/L$)). There was no evidence of urothelial carcinoma on cytology. Urine cultures were negative for infection including Chlamydia and Gonorrhoea.

Initial imaging with ultrasound showed a midline mixed echogenic mass with central calcification at the dome of the bladder (Fig. 1). Cystoscopy revealed a large inflammatory mass midline of the posterior bladder wall with heavy calcification centrally. Biopsy was consistent with an urachal adenocarcinoma. CT scan of the abdomen and pelvis showed a lobulated mixed solid and cystic mass centred in the anterosuperior aspect of the urinary bladder, measuring up to 5.5 cm containing low attenuation material (25 Hounsfield units) and coarse calcification centrally. The mass was abutting the uterus and sigmoid colon with no gross evidence of invasion on CT (Fig. 2).

MRI of the pelvis with contrast demonstrated a heterogeneous irregular mass in the anterosuperior aspect of the urinary bladder that is T1 isointense (Figs. 3A and D) and T2 hyperintense (Figs. 3B and E) relative to the bladder wall with central non-enhancement and peripheral enhancement (Figs. 3C and F). Although there was serosal enhancement and abutment against the anterior surface of the uterus and sigmoid colon, there was no convincing evidence of invasion. There was no enhancement along the urachal remnant.

^{18}F FDG PET/CT showed moderately increased FDG uptake at the margin of the mass (SUVmax up to 5.8) corresponding

to the enhancing soft tissue components on CT and MR with extensive central photopenia corresponding to the low attenuation region on CT and T2 hyperintense region on MR. There was no evidence of regional nodal or distant FDG avid metastasis (Fig. 4).

Colonoscopic findings were normal. The patient underwent robotic partial cystectomy with pelvic lymph node dissection. Histopathology demonstrated that the tumour invaded transmurally through the bladder wall with extensive extracellular mucin centrally consistent with an invasive adenocarcinoma of mucinous type. The surgical resection margins and pelvic lymph nodes were clear of tumour.

Discussion

The urachus is a tubular structure extending from the apex of the bladder to the umbilicus during foetal development and normally deteriorate to a fibrous band, also known as the median umbilical ligament [1]. The urachal lumen is lined with a transitional epithelium that has the potential for malignant transformation. Malignant neoplasms of the urachus represent less than 0.5% of all bladder tumors with adenocarcinoma being the most common histological type (up to 90%) with the remaining subtypes being urothelial, squamous and sarcomatoid [1–4]. Urachal carcinomas are more common in males (59%) and are most commonly found in middle-aged and elderly adults [1,5].

Majority of urachal adenocarcinomas develop in the inferior aspect of the urachus adjacent to the urinary bladder. Both CT and MR imaging have been demonstrated to be useful modalities in evaluating urachal carcinoma including for the

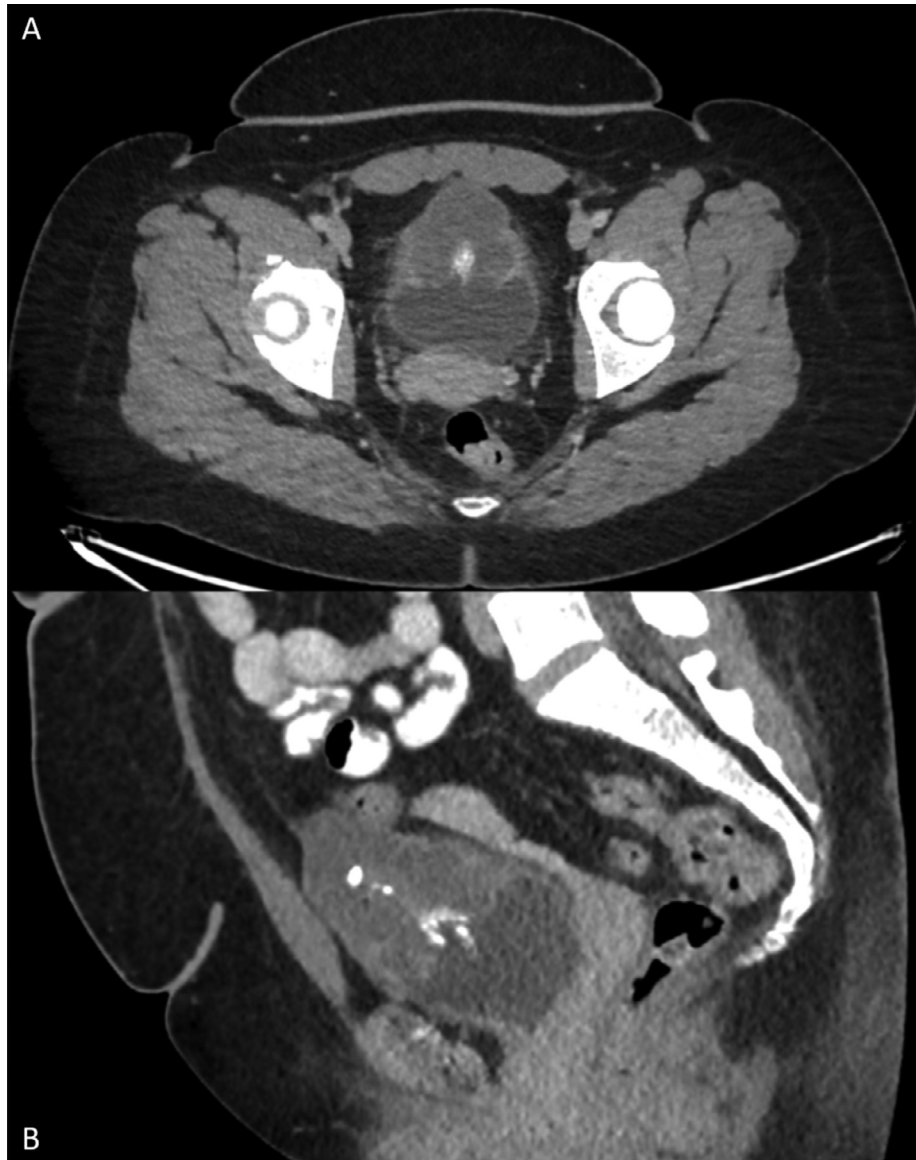


Fig. 2 – Axial (A) and sagittal (B) CT scan of the abdomen and pelvis with contrast showing a midline lobulated mixed solid and cystic mass centred in the anterosuperior aspect of the urinary bladder, measuring up to 5.5 cm containing low attenuation material (25 Hounsfield units) and coarse calcification centrally. The mass was abutting the uterus and sigmoid colon superiorly with no gross evidence of invasion.

evaluation of local disease, tumour extension, and the presence of pelvic lymph node involvement or distant metastases. Characteristic CT features of urachal carcinoma is a midline mass anterosuperior to the dome of the bladder with heterogeneous low attenuation components which represent mucinous content as in our case. Calcification have been reported in 50%-70% of cases and the presence of calcification in the midline along the course of the urachal tract is considered pathognomonic for urachal adenocarcinoma [1,4].

On MR imaging, urachal carcinoma normally manifest as a midline juxtavesicular mass with heterogeneous high signal intensity on T2-weighted images which may represent mucin content with solid soft tissue components being isointense to

bladder soft tissue on T1-weighted images and enhance following administration of Gadolinium contrast [6,7].

Unlike CT or MR, there have been variable FDG PET findings with urachal tumours potentially due to considerable variation in their hypermetabolism [8]. FDG PET is known to be limited in the evaluation of mucinous tumours, particularly in hypocellular lesions with abundant mucin which can result in high false-negative results [8,9]. As demonstrated in our case, the central low attenuation region on CT and T2 hyperintense region on MR was photopenic which was consistent with paucicellular and mucin rich centre on histopathology. However, not all urachal adenocarcinomas are FDG PET negative. A number of cases have reported mild to moder-

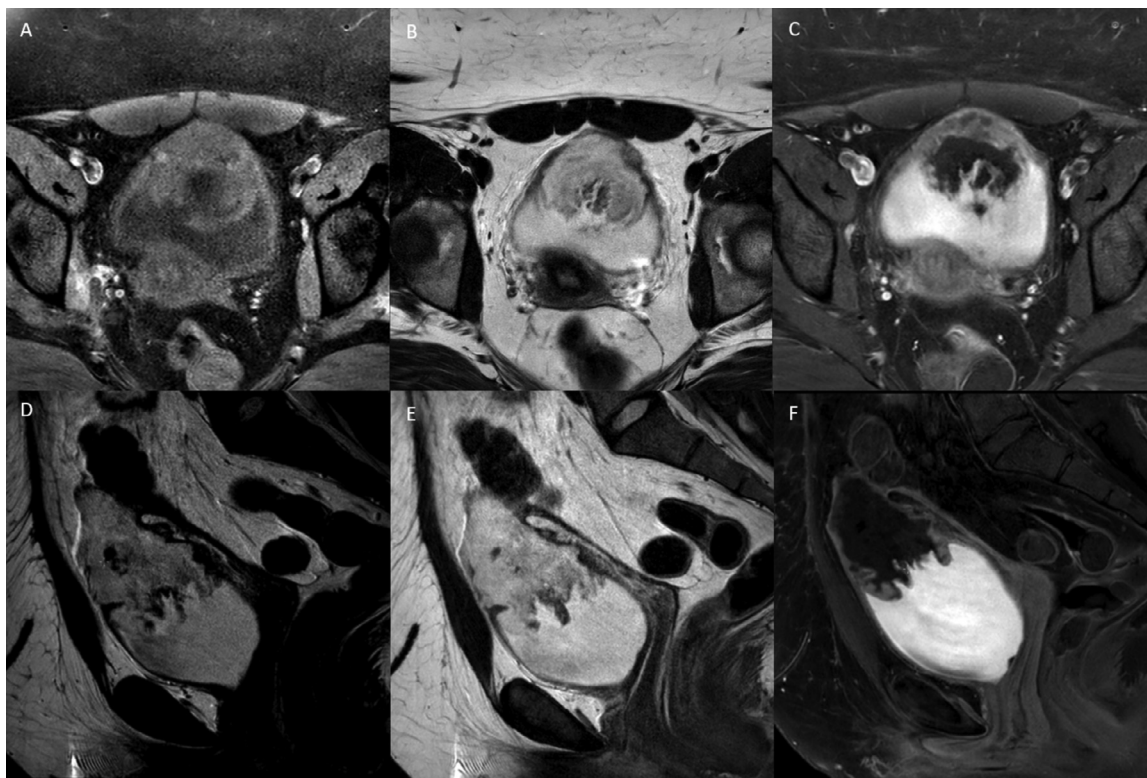


Fig. 3 – MRI of the pelvis with intravenous Gadolinium contrast demonstrates a heterogeneous irregular mass in the anterosuperior aspect of the urinary bladder that is T1 isointense (A and D – axial and sagittal fat suppressed T1-weighted images) and T2 hyperintense (B and C – axial and sagittal fat suppressed T2) relative to the urinary bladder wall with central non-enhancement and peripheral enhancement (E and F – contrast enhanced axial and sagittal fat suppressed T1-weighted images). Although there was serosal enhancement and abutment against the anterior surface of the uterus and sigmoid colon, there was no convincing evidence of invasion. There was no enhancement along the urachal remnant.

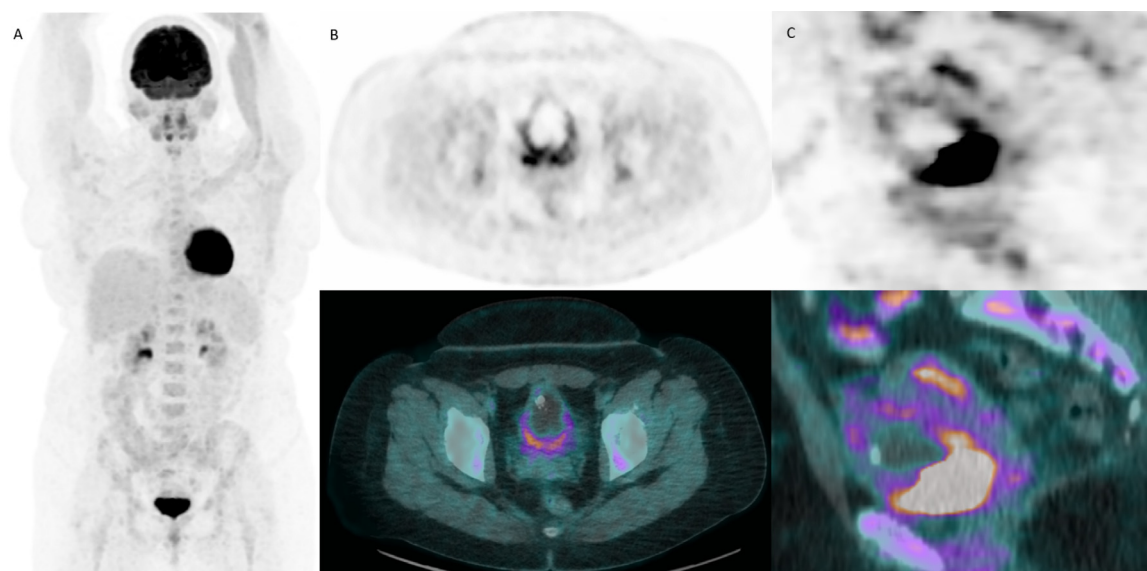


Fig. 4 – ^{18}F FDG PET/CT (A – MIP, B – axial PET and fused PET/CT and C – sagittal PET and fused PET/CT) shows moderately increased FDG uptake at the margin of the mass (SUVmax up to 5.8) corresponding to the enhancing soft tissue components on CT and MR with extensive central photopenia corresponding to the low attenuation region on CT and T2 hyperintense region on MR. There was no evidence of regional nodal or distant FDG avid metastasis.

ately increased FDG uptake [10–12]. In our case, the peripheral soft tissue component demonstrate moderately increased FDG uptake at the margins. It is postulated that the PET findings may be dependent on the degree solid cellular component of the mucinous tumour with the thickness of the tumour walls playing a role in the degree of FDG uptake [8]. The variability of FDG avidity of mucinous tumours highlights the need for additional cross-sectional imaging, such as CT and MRI, to address the possibility of mucinous malignancy.

Conclusion

Malignant urachal neoplasms are rare tumours that can arise from the urachal remnant with adenocarcinoma being the most common histological type. We present a case of urachal adenocarcinoma of mucinous type in a 24 year-old female patient with characteristic features on CT and MRI which also exhibit moderately increased FDG avidity.

Patient consent

Patient consent was obtained.

REFERENCES

- [1] Parada Villavicencio C, Adam SZ, Nikolaidis P, Yaghmai V, Miller FH. Imaging of the urachus: anomalies, complications, and mimics. *Radiographics* 2016;36(7):2049–63.
- [2] Bruins HM, Visser O, Ploeg M, Hulsbergen-van de Kaa CA, Kiemeny LALM, Witjes JA. The clinical epidemiology of urachal carcinoma: results of a large, population-based study. *J Urol* 2012;188:1102–7.
- [3] Dhillon J, Liang Y, Kamat AM, Siefker-Radtke A, Pinney CP, Czerniak B, et al. Urachal carcinoma: a pathologic and clinical study of 46 cases. *Hum Pathol* 2015;46(12):1808–14.
- [4] Koster IM, Cleynndert P, Giard RW. Best cases from the AFIP: urachal carcinoma. *Radiographics* 2009;29(3):939–42.
- [5] Mylonas KS, O Malley P, Ziogas IA, El-Kabab L, Nasioudis D. Malignant urachal neoplasms: a population-based study and systematic review of literature. *Urol Oncol* 2017;35(1):33.e11–33.e19.
- [6] Wong-You-Cheong JJ, Woodward PJ, Manning MA, Davis CJ. From the archives of the AFIP: inflammatory and nonneoplastic bladder masses—radiologic-pathologic correlation. *RadioGraphics* 2006;26(6):1847–68.
- [7] Hussain SM, Outwater EK, Siegelman ES. MR imaging features of pelvic mucinous carcinomas. *Eur Radiol* 2000;10(6):885–91.
- [8] Zeman M, Silver E, Akin E. CT and PET findings for urachal adenocarcinoma: a case report. *Ann Clin Case Rep* 2017;2:1252.
- [9] Berger KL, Nicholson SA, Dehdashti F, Siegel BA. FDG PET evaluation of mucinous neoplasms: correlation of FDG uptake with histopathologic features. *AJR Am J Roentgenol* 2000;174(4):1005–8.
- [10] Guimaraes MD, Bitencourt AGV, Lima ENP, Marchiori E. [18F]FDG PET/CT findings in the unusual urachal adenocarcinoma. *Clin Nucl Med* 2014;39:831–4.
- [11] Li X, Liu S, Yao S, Wang M. A rare case of urachal mucinous adenocarcinoma detected by 18F-FDG PET/CT. *Clin Nucl Med* 2015;40:282–5.
- [12] Yang G, Wang Z, Liu S, Wu F, Li D. A rare case of urachal carcinoma metastatic to thoracic vertebra detected by FDG PET/CT. *Clin Nucl Med* 2017;42(7):544–6.