On-line Case Report

Urological pathology causing free air under the diaphragm?

SUDHANSHU CHITALE¹, MANASH DEBBARMA¹, PATRICK WILSON², NEIL BURGESS¹, DANIELLE PEAT³

Departments of ¹Urology, ²Radiology and ³Histopathology, Norfolk and Norwich University Hospital NHS Trust, Norwich, UK

ABSTRACT

We report a case of long-standing, keratinising, squamous metaplasia of the bladder with undiagnosed malignant transformation to squamous cell carcinoma presenting as acute peritonitis secondary to spontaneous perforation of the bladder tumour. This presentation as an acute abdomen mimicking a perforated peptic or duodenal ulcer is the most unusual aspect of the case.

Keywords: Squamous cell carcinoma, Perforation, Bladder, Squamous metaplasia

Squamous cell carcinoma of the bladder is rare (1.2–6.7%) in the Western world and its complication as perforation is even rarer. We present one such case, underlining difficulties faced with its management and discuss relevant literature.

Case report

A 71-year-old man, a non-insulin dependent diabetic and hypertensive, presented with acute abdominal pain, signs of peritonitis and sepsis. CT revealed free air under the diaphragm (Fig. 1A) without any gastrointestinal pathology.

Some 15 years previously, he had noticed altered bowel habit and described pneumaturia. Barium enema and CT had shown thickened rectal wall. Urological investigations revealed detrusor failure, bulbar urethral stricture, a patch of keratinising squamous metaplasia high up on the posterior bladder wall but no fistula. Surveillance with annual check cystoscopies $\pm$ biopsies

confirmed unchanged bladder pathology. Intermittent self-catheterisation bid successfully addressed detrusor failure and urethral stricture to date.

Exploratory laparotomy revealed a grossly thickened bladder, induration of the dome, anterioposterior walls and free fluid in the pelvis. This was noted on the pre-operative CT (Fig. 1B), highlighting an area suggestive of central necrosis of the bladder dome, free air within the bladder and right-sided pelvic fluid collection.

At exploration, a small central perforation was noted over the indurated dome. It was enlarged and biopsies taken from its edges before closing the defect in two layers. There were no adhesions between the bladder and the bowel to suggest an enterovesical fistula. A catheter specimen of urine grew coliform organisms (*Enterobacter* spp.).

Histology revealed a poorly differentiated infiltrating squamous cell carcinoma with vascular invasion (Fig. 2). Despite no evidence of metastases, he was unfit for radical cystectomy and sadly died 2 months later.

Correspondence to: Sudhanshu Chitale, Department of Urology, Norfolk and Norwich University Hospital NHS Trust, Colney Lane, Norwich NR4 7UJ, UK. T: +44 (0)1603 286777; F: +44 (0)1603 287884; E: chitalenorwich@aol.com

Figure 1 (A) Free air under the right hemidiaphragm. (B) Thickened bladder with intracavity gas, necrosis at the dome, central perforation and free fluid (urine) in the pelvis on the right.

Discussion

We report a case of long-standing, keratinising, squamous metaplasia of the bladder with undiagnosed malignant transformation to squamous cell carcinoma presenting as acute peritonitis secondary to spontaneous perforation of the

tumour. Presentation as an acute abdomen mimicking a perforated peptic/duodenal ulcer is the most unusual aspect of the case.

Squamous cell carcinoma comprises 1.2–6.7% of all bladder tumours,^{1–3} in a non-bilharzial environment in the Western world. Foci of squamous differentiation

Figure 2 Full-thickness biopsy from the edges of the bladder perforation showing squamous cell carcinoma infiltrating the perivesical fat (hematoxylin-eosin stain $\times 400$).

associated with transitional cell carcinoma of the bladder are more commonly seen than pure squamous cell carcinoma. It is more common in men, occurring at a mean age of 59–71 years.^{1–3} The majority of patients present with haematuria, others with irritative lower urinary tract symptoms. Most tumours are advanced at presentation and moderately to poorly differentiated. Keratinisation noted in all cases accounts for 5–95% of the tumour bulk.¹ Incidence of tumour necrosis ranges from 0–60% and is inversely related to the degree of differentiation.¹ Tumour necrosis, we postulate, could be the underlying mechanism for a spontaneous pathological perforation through the centre of the tumour and air and urine escaping, the latter causing peritonitis. Catheter trauma could have precipitated bladder perforation through the central tumour necrosis. Air in the bladder and free air under the diaphragm could be explained as a consequence of pre-operative urethral catheterisation or due to urinary infection secondary to gas forming Gram-negative bacteria or coliform organisms native to the bladder. In the presence of an impaired host immune response due to chronic debility and systemic co-morbidity like diabetes, uropathogens with the capability of producing gas (CO₂ from fermentation of sugar in the urine and tissues in diabetics) can also use necrotic tissue as a substrate to generate gas within the bladder cavity as was evident in our case.

Most cases of squamous cell carcinoma are associated with lesions such as keratinising squamous metaplasia, non-keratinising squamous metaplasia, squamous cell carcinoma *in situ*, squamous metaplasia with dysplasia, verrucous squamous hyperplasia and extensive condyloma acuminatum. Keratinising squamous metaplasia is a premalignant condition⁴ associated with invasive squamous cell carcinoma and results from chronic irritative stimuli involving the bladder namely bladder stones, recurrent urinary tract infections and chronic in-dwelling urinary catheters.^{2,4} Squamous cell carcinoma developing secondary to implantation of PTFE in the bladder in the absence of chronic/recurrent urinary tract infection has also been reported.

Radical cystectomy with lymph node dissection offers significant survival benefit in a subset of patients;¹ however, due to the advanced stage of most squamous cell carcinomas at presentation, its long-term prognosis remains poor and management controversial. For premalignant keratinising squamous metaplasia, regular cystoscopic surveillance with indefinite follow-up is recommended due to a wide variation in the lag time to potential malignant transformation. Prophylactic cystectomy has been suggested in selected patients with long-life expectancy and extensive bladder involvement (> 50%).⁴

Our case highlights the importance of close, long-term endoscopic surveillance for keratinising squamous metaplasia with regular biopsies and emphasises the value of radiological imaging with ultrasonography or CT for early diagnosis of malignant transformation in a silently advancing disease. Such a pre-existent established bladder pathology should be taken into account in assessing patients presenting with an unusual clinical picture. This case also underlines the importance of keeping concomitant diabetes under stringent control, failing which, even common uropathogens such as *Escherichia coli* and *Enterococcus* spp. can cause severe infection with gas formation in the parenchyma and the collecting system with mixed acid fermentation of glucose as the primary pathway for gas production.⁵ CT scan is the investigation of choice for diagnosis as well as prognosis.⁵

Spontaneous perforation following occult malignant transformation of keratinising squamous metaplasia of the bladder associated with diabetes and urinary tract infection has not been reported to our knowledge. Urological pathology as an underlying cause of an acute abdomen should perhaps be considered in all patients with pre-existent significant bladder pathology and an accurate diagnosis based on pre-operative CT would help surgeons plan definitive management in individual cases, reducing associated morbidity and mortality.

Since the first published report of spontaneous perforation of bladder in 1950 a few case reports have appeared in the literature with an attempt made at classifying atraumatic bladder perforation. The underlying urological conditions, however, have been so variable and rare that, unless the primary general surgeon/urologist considers one in the differential diagnosis, its pre-operative diagnosis is most likely to be missed.

References

1. Lagwinski N, Thomas A, Stephenson AJ, Campbell S, Hoschar AP, El-Gabry E *et al*. Squamous cell carcinoma of the bladder: a clinicopathologic analysis of 45 cases. *Am J Surg Pathol* 2007; **31**: 1777–87.
2. Riadh BS, El Atat R, Sfaxi M, Derouiche A, Kourda N, Chebil M. Clinical presentation and outcome of bladder schistosoma-unrelated squamous cell carcinoma: report on 33 consecutive cases. *Clin Genitourin Cancer* 2007; **5**: 409–12.
3. Gonzalez Resina R, Sanchez Bernal ML, Perez Espejo MP, Rodriguez Corchero FJ, Arguelles Salido E, Campoy Martinez P. Squamous cell carcinoma of the bladder. Review of our case series. *Arch Esp Urol* 2006; **59**: 785–90.
4. Castillo CM, Ha CY, Gater DR, Grob BM, Klausner AP. Prophylactic radical cystectomy for the management of keratinizing squamous metaplasia of the bladder in a man with tetraplegia. *J Spinal Cord Med* 2007; **30**: 389–91.
5. Huang JJ, Chen KW, Ruaan MK. Mixed acid fermentation of glucose as a mechanism of emphysematous urinary tract infection: *J Urol* 1991; **146**: 148–51.