- 16 Mahant S, Friedman J, MacArthur C. Renal ultrasound findings and vesicoureteral reflux in children hospitalised with urinary tract infection. *Arch Dis Child* 2002;**86**:419–20.
- 17 Oostenbrink R, van der Heijden AJ, Moons KG, et al. Prediction of vesicoureteric reflux in childhood urinary tract infection: a multivariate approach. *Acta Paediatr* 2000;**89**:806–10.
- 18 McGinn TG, Guyatt GH, Wyer PC, et al. Users' guides to the medical literature: XXII: how to use articles about clinical decision rules. Evidence-Based Medicine Working Group. *JAMA* 2000;**284**:79–84.
- 19 Wade A. Derivation versus validation. *Arch Dis Child* 2000;**83**:459–60.
- 20 Laupacis A, Sekar N, Stiell IG. Clinical prediction rules. A review and suggested modifications of methodological standards. *JAMA* 1997;**277**:488–94.
- 21 Lebowitz RL, Olbing H, Parkkainen KV, et al. International system of radiographic grading of vesicoureteric reflux. International Reflux Study in Children. *Pediatr Radiol* 1985;**15**:105–9.
- 22 Blane CE, DiPietro MA, Strouse PJ, et al. Pediatric renal pelvic fullness: an ultrasonographic dilemma. *J Urol* 2003;**170**:201–3.
- 23 Smolkin V, Koren A, Raz R, et al. Procalcitonin as a marker of acute pyelonephritis in infants and children. *Pediatr Nephrol* 2002;**17**:409–12.
- 24 Newman TB, Bernzweig JA, Takayama JI, et al. Urine testing and urinary tract infections in febrile infants seen in office settings: the Pediatric Research in Office Settings' Febrile Infant Study. *Arch Pediatr Adolesc Med* 2002;**156**:44–54.
- 25 Concato J, Feinstein AR, Holford TR. The risk of determining risk with multivariable models. *Ann Intern Med* 1993;**118**:201–10.
- 26 Leroy S, Adamsbaum C, Marc E, et al. Procalcitonin as a predictor of vesicoureteral reflux in children with a first urinary tract infection. *Pediatrics* 2005;**115**:e706–9.
- 27 Chalumeau M, Hadjiathanasiou CG, Ng SM, et al. Selecting girls with precocious puberty for brain imaging: validation of European evidence-based diagnosis rule. *J Pediatr* 2003;**143**:445–50.

IMAGES IN PAEDIATRICS.....

doi: 10.1136/adc.2005.083741

Osteomyelitis of the humerus complicating BCG vaccination

An 18 month old boy presented with reluctance to move his left arm after a fall. He had received bacille Calmette-Guérin (BCG) vaccination six months prior to presentation. Radiological examination of the humerus showed a proximal pathological fracture and a number of lytic lesions. Magnetic resonance imaging showed an aggressive lesion within the proximal metaphysis with cortical disruption.

A bone biopsy showed inflammatory tissue containing Langhan's giant cells and granulomatous inflammatory infiltrate. Surgical washout and debridement removed large amounts of caseous material from the bony cavity. MTB ELISPOT was negative and PPD ELISPOT positive, confirming the diagnosis of BCG osteomyelitis.

Although BCG is generally well tolerated, some serious adverse reactions can occur.¹ The most frequent complications are local subcutaneous abscess or suppurative regional lymphadenitis. The factors responsible for BCG complications include the vaccine strain, faulty intradermal technique, and overdose.¹ Fatal disseminated disease has been described in congenital or acquired disturbances of cellular immunity, including HIV disease. The incubation period for BCG osteomyelitis ranges from six to nine months after vaccination and in most cases the metaphyses and epiphyses of long bones are affected.² This differs from disease caused by *Mycobacterium tuberculosis*, which more commonly occurs in the spine and weight bearing joints in older children and adults.

BCG is generally highly susceptible to antituberculous drugs, including isoniazid, rifampin, and ethambutol. Recent

Figure 1 These two radiographs show the remodelling and improvement in the volume of cortical and trabecular bone. The first shows a lucent lesion in the proximal diaphysis with modelling deformity and a periosteal reaction. This fills in slowly with time and ongoing chemotherapy.

reports have highlighted the potential for isoniazid resistance, showing the potential role for PCR in diagnosis and sensitivity testing.³ As in this case, treatment for a period of 9–12 months together with surgical evacuation usually results in good outcome.²

S Segal, A J Pollard

Dept of Paediatrics, University of Oxford, John Radcliffe Hospital, Oxford, UK

C Watts

Dept of Radiology, University of Oxford, John Radcliffe Hospital

A Wainwright

Dept of Orthopaedics, Nuffield Orthopaedic Centre, Oxford, UK

A Lalvani

Dept of Medicine, University of Oxford, John Radcliffe Hospital

J Connell

Dept of Paediatrics, Wexham Park Hospital, Slough, UK

Correspondence to: Dr S Segal, Department of Paediatrics, University of Oxford, Level 4, John Radcliffe Hospital, Oxford OX3 9DU, UK; shelley.segal@paediatrics.ox.ac.uk

Competing interests: none declared

References

- 1 Lotte A, Wasz-Hockert O, Poisson N, et al. BCG complications. Estimates of the risks among vaccinated subjects and statistical analysis of their main characteristics. *Adv Tuberc Res* 1984;**21**:107–93.
- 2 Kroger L, Korppi M, Brander E, et al. Osteitis caused by bacille Calmette-Guérin vaccination: a retrospective analysis of 222 cases. *J Infect Dis* 1995;**172**:574–6.
- 3 Hesselting AC, Schaaf HS, Victor T, et al. Resistant *Mycobacterium bovis* Bacillus Calmette-Guérin disease: implications for management of Bacillus Calmette-Guérin disease in human immunodeficiency virus-infected children. *Pediatr Infect Dis J* 2004;**23**:476–9.