Molecular confirmation of invasive infection caused by Chaetomium globosum

Identification of the causative organism in invasive fungal infections is difficult. Accurate and reliable diagnostic methods are required in light of the increasing incidence of emerging fungal infections.1 We recently described a method for speciating fungi in formalin fixed, paraffin wax embedded tissue sections.2 DNA is extracted using a modification of the protocol for the TaKaRa DEXPATTM kit (TaKaRa Biomedicals, Cambridge Biosciences, Wokingham, UK), with additional steps using lyticase and ethanol precipitation. Amplification of the DNA is performed using panfungal primers and a method based on that described by Elsea et al.3 Identification to species level can be achieved by Southern hybridisation with a probe that binds Aspergillus fumigatus, A flavus, and A versicolor. Polymerase chain reaction products that do not hybridise with this probe are subsequently identified by sequence analysis.4

We have used this method to confirm the diagnosis in the case of a patient with acute myeloid leukaemia and pneumonia caused by Chaetomium globosum. We previously reported the details of this case and discussed the associated diagnostic difficulties.1 A computed tomography chest scan revealed cavitating lesions characteristic of an invasive fungal infection in the right upper lobe and a right lobectomy was performed. Histology demonstrated branching hyphae invading blood vessels that were “consistent with aspergillus”. However, many filamentous fungi resemble aspergillus species histologically, and identification relies on culturing the organism from the tissue. In this case, C globosum was cultured from the tissue specimen and identified six weeks later, by which time the patient had died. Moreover, such microbiological identification cannot differentiate between environmental contamination and causative organisms. Immunohistochemical staining of the tissue was subsequently carried out using a monoclonal antibody directed specifically against A fumigatus, A flavus, and A niger. Results were negative, confirming that the infection was not caused by these common aspergillus species. Chaetomium globosum is a rare pathogen but a common contaminant, so we were left with a presumptive diagnosis.

We have now achieved a definitive, molecular diagnosis of an invasive fungal infection caused by C globosum in this case using the method described above. Sections from the original paraffin wax embedded tissue were cut with a sterile microtome blade and two 10 μm thick sections were subjected to DNA extraction, after discarding the outer section. A positive result was obtained after polymerase chain reaction amplification with panfungal primers, but subsequent hybridisation with the aspergillus specific probe yielded a negative result. The DNA was purified using Wizard® PCR Preps DNA purification system (Promega, Madison, Wisconsin, USA), according to the manufacturer’s instructions. The DNA was commercially sequenced (Cytoxyn, Cambridge, UK), after which sequence analysis was performed using the EMBOSS software package (HGMP-RC: Medical Research Council, London, UK). The sequence was identified as C globosum using a BLAST search of Genbank and EMBL nucleotide sequence databases and subsequently submitted to the EMBL database (accession number AJ781794). The C globosum isolate had been added to the UK National Collection of Pathogenic Fungi as NCPI 7115. We subcultured this isolate then extracted, purified, and sequenced the genomic DNA. The sequence was identical to that of DNA extracted from the tissue sample, confirming the causative role of this organism in our case.

With the growing population of immunocompromised patients and the broadening spectrum of antifungal agents available it is imperative that we can accurately identify the organisms causing invasive fungal infections. This case illustrates the value of molecular tools to enhance the diagnostic process.

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Osseous metaplasia in a benign ovarian cyst in association with cloacal anomaly

Osseous metaplasia has been described at many sites and in association with a large number of tumours. However, previous reports of osseous metaplasia in ovarian lesions are rare, there being only three published cases, which were associated with papillary serous carcinoma, thecoma, and endometrioma.1 We report a case of osseous metaplasia hitherto undescribed in a benign ovarian cyst in a girl with a complex urogenital malformation.

The patient was a 16 year old girl, who was diagnosed with a complex cloacal anomaly at birth, requiring posterior sagittal anocutreal–ginourethreoplasty, followed by further lower urinary tract reconstructive procedures. At the time of surgery, a large multiseptated cyst was noted occupying most of the pelvis behind the augmented bladder on the right and crossing the midline, closely adherent to the right ovary and right fallopian tube. The right ovary was partially resected along with the cyst. Postoperative recovery was uneventful. Histological examination demonstrated a complex tubal cyst with chronic salpingitis, in addition to a simple follicular ovarian cyst, in the wall of which osseous metaplasia was noted (fig 1). The entire specimen was embedded and multiple sections examined, but there were no additional features present to suggest a teratoma.

The pathogenesis of osseous metaplasia is unclear, but in some circumstances appears to be an unusual reaction to tissue damage and repair. It is interesting that the previously reported case associated with an endometriotysisic ovarian cyst also occurred in a locally abnormal pelvis, in a supernumerary ovary.2 Osseous metaplasia in a benign ovarian cyst appears to be an unusual incidental finding of unknown importance and aetiology, which is more common in normal ovaries.

Figure 1 Photomicrograph of a simple follicular ovarian cyst with focal osseous metaplasia in a 16 year old girl with a cloacal anomaly. Original magnification, × 40.

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anatomically abnormal ovarian tissue in women of reproductive age.

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References

Congenital bronchogenic cyst in the gastric mucosa

Bronchogenic cysts are congenital anomalies evolving from the ventral foregut between the 3rd and the 7th prenatal weeks. They are lined with cuboidal or pseudostratified ciliated epithelium and may or may not be surrounded by elastic fibres, smooth muscle, and cartilage. Bronchogenic cysts are divided into thoracic and abdominal.1 Abdominal bronchogenic cysts are rare, particularly those located exclusively within the confines of the gastric wall. Despite the fact that Gensler and colleagues’ described the first case nearly 50 years ago, only two additional cases have been reported.2 Recently, we identified a new case of bronchogenic cyst in the gastric mucosa. The purpose of this letter is to draw attention to an important differential diagnosis between gastric congenital intramucosal cysts and acquired intramucosal cysts also lined with ciliated cells.3 A 26-year-old Swedish man presented because of periodic epigastric pain. The pain began 18 months previously and was periodically treated with proton pump inhibitors. Palpation resulted in epigastric pain. Oesophageal manometry and pH were normal. Gastroscopy showed mild oesophagitis and normal gastric mucosa. Pinch biopsies revealed grade 1 oesophagitis and normal gastric mucosa. Pinch biopsies revealed grade 1 oesophagitis and normal gastric mucosa without Helicobacter pylori infection. However, an intramucosal cyst was found in one of the biopsies from the corpus. That cyst was lined with pseudostratified epithelium built from cuboidal cells (fig 1), some of them vacuolated. Cartilaginous tissue was not found but a lymphatic follicle was present in the lamina propria. The adjacent mucosa of the fundus was normal. The cells lining the luminal aspect of the cyst had densely packed cilia (fig 1). Each cilium was approximately 6 μm long and stained positively for tubulin B (fig 2). Staining with periodic acid Schiff diastase revealed only one positive clear cell. The aforementioned vacuolated cells were periodic acid Schiff negative. Staining for Ki67 (clone MIB1) showed no signs of epithelial proliferation. The patient received ondansetron medication and the symptoms disappeared.

The histological lining of this bronchogenic cyst differs from other reported intramucosal gastric cysts also lacking cartilage; namely: foveolar, fundic, pyloric, intestinal metaplasic, and ciliated metaplastic cysts.4 Cysts with ciliated metaplasia are usually located in the antrum and they are lined with a single row of gastric seromucinous cuboidal cells or with intestinal metaplastic goblet cells that have irregular cilia. Cysts with ciliated metaplasia evolve as a result of environmental factors, particularly in Asian patients harbouring a gastric carcinoma of the intestinal type.5-7 Gastric bronchogenic cysts are rare; a similar type of cyst has not been found in two large series comprising 1675 gastric biopsies6 and 3406 resected stomachs7 from patients dwelling in disparate geographical regions.

In conclusion, congenital bronchogenic cysts should be differentiated from acquired ciliated gastric cysts evolving as a consequence of environmental factors.8

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Figure 2 Gastric intramuscular bronchogenic cyst showing ciliated structures expressing tubulin B (immunohistochemical staining for tubulin B; original magnification, ×25).

References

VEGF-D and HIF-1α in breast cancer

In a recent paper in the Journal of Clinical Pathology, Currie et al used immunohistochemistry on tissue microarrays to assess the expression of the hypoxia inducible factor 1α (HIF-1α) protein in breast cancer.9 We point out in a letter in this issue of the journal,1 microbial microarrays are not very suitable for HIF-1α immunohistochemistry because focal perinecrotic HIF-1α staining is easily missed in the small tissue samples forming a tissue microarray. However, this perinecrotic type of HIF-1α expression is relevant in breast cancer.1

Furthermore, the authors assessed HIF-1α expression considering both the intensity and extent of nuclear and cytoplasmic reactivity. To our knowledge, there are no data supporting a functional role for cytoplasmic HIF-1α expression in breast cancer. Therefore, previous studies have only considered nuclear staining. Lastly, the fact that the authors define how they arrive at a score in an individual case after considering “both the intensity and extent of nuclear and cytoplasmic reactivity”, and also the threshold used in statistical analysis is not provided. Further enlightenment on these matters would help us to appreciate the value of their findings. Perhaps, the lack of prognostic value of vascular endothelial growth factor D, which induces lymphangiogenesis, can be explained by the absence of lymphangiogenesis in invasive breast cancer.1

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References

Expression of HIF-1α in human tumours

We have read with interest the recent paper by Jubb et al on the expression of hypoxia inducible factor 1α (HIF-1α) in human tumours. We note that they report only 5% of ductal adenocarcinomas expressing HIF-1α positive. This proportion is unusually low compared with our own data and those of other workers. In our various studies, the proportion of HIF-1α positive breast cancers varied from 44% to 80%8. From other groups, these percentages varied from 56% to 76%.9 We believe that this discrepancy may be caused by the use of tissue microarrays. In breast cancer, HIF-1α often shows pronounced intratumour heterogeneity because of focal perinecrotic staining, which is clinically highly relevant. Even patients with only 5% of cells overexpressing

Figure 1 Gastric intramuscular bronchogenic cyst with ciliated pseudostratified epithelium (haematoxylin and eosin stain; original magnification, ×50).
HIF-1α has a much worse prognosis. Thus, tissue arrays probably underestimate the true frequency of HIF-1α overexpression in breast cancer. Hence, data from studies on HIF-1α derived from tissue arrays are probably less reliable with regard to associations between HIF-1α and other biomarkers and prognosis for invasive breast cancer. Therefore, we believe that intentional tumour sections are superior for the assessment of HIF-1α overexpression in this type of cancer. For other cancers with a more diffuse type of staining this may be different.

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References

Authors’ reply
We thank Professor van Diest and colleagues for their letter raising some interesting issues about hypoxia inducible factor 1α (HIF-1α) in breast cancer. Our study examined vascular endothelial growth factor D (VEGF-D) expression in breast cancer and correlated expression with clinicopathological variables, with an emphasis on hypoxia markers. Van Diest et al suggest that tissue microarrays (TMAs) are unsuitable for the analysis of HIF-1α because they may miss a particular pattern of HIF-1α staining that has prognostic relevance. However, the clinical impact of these patterns is unclear because in their study HIF-1α was highly associated with necrosis and grade and the survival analysis was not multivariate. Nevertheless, we agree that we identified fewer HIF-1α positive tumours than van Diest et al, who reported 75%, 54%, and 44% positivity in three studies using a 1% cutoff value, or 34% in another study when using a 5% cutoff value. However, although van Diest et al suggest that others have found a similar range of HIF-1α positivity (56% and 76%), appraisal of the published data shows that only strong HIF-1α staining is used, then these studies show 23% HIF-1α positivity. Moreover, Zhong et al using whole tissue sections of breast tumours reported strong HIF-1α expression in only 12%. We used a semiquantitative score of negative, weak staining, or strong staining and considered strong staining as positive (the proportion of cells was also noted (0, 0%; 1, 1–10%; 2, 11–50%; 3, 51–80%; and 4, 81–100%), but in practice when strong staining was present all the tumour cells were positive. If we re-stratify our cases using the criteria of van Diest and colleagues—nuclei that are “completely and darkly stained” and >1% cutoff point— we have a positivity rate of 78%, which is within the range reported by van Diest et al. Indeed, because each core within a TMA can hold up to 1000 cells, we may be analysing similar amounts of tumour, but the methodology in the van Diest group’s papers with regard to the number of cells, the ranges, medians, etc is unclear, so it is not possible to assess this. Thus, we think that although we may miss some HIF-1α positive cases, it is probably only a small proportion, and may be compensated for by the absence of variability in staining that is common in studying large series by whole tissue sections. Furthermore, because we specifically wish to analyse the relationship between molecular markers in the same region of the tumour (in the individual core/exemplar), we view the use of TMAs as an advantage.

Van Diest and colleagues also raise the issue of the subcellular localisation of HIF-1α. Cytoplasmic expression of HIF-1α is well recognised. To ignore it appears to us premature just because it does not fit in with current models. Many so called cytoplasmic or nuclear only proteins have now been shown to shuttle to and fro between the two compartments. Indeed, it has been shown that a nuclear location is not required for HIF-1α stabilisation and that HIF-1α undergoes oxygen dependent proteasomal degradation in both the nucleus and the cytoplasm.

Lastly, van Diest et al suggest that the lack of an association between VEGF-D and prognosis may be explained by the absence of lymphangiogenesis in breast cancer. The notion that VEGF-D enhances lymphangiogenesis and thereby influences nodal status and prognosis is somewhat one dimensional because VEGF-D has other functions in addition to lymphangiogenesis, including lymphatic growth, lymphatic maintenance, and angiogenesis.

Thus, we think that the lack of an association is more likely the result of several factors leading to nodal metastasis, including VEGF-C, with differences in processing resulting in changes in receptor affinity. Furthermore, it is also a combination of factors that a single factor will be clinically useful.

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References


Calendar of Events
Full details of events to be included should be sent to Maggie Butler, Technical Editor JCP, The Cadars, 36 Queen Street, Castle Hedingham, Essex CO9 3HA, UK. email: maggie.butler@btpenworld.com

Second Annual Meeting of the British Association of Gynaecological Pathologists
9–13 May 2005, Hammersmith Hospital and Imperial College, London, UK
Further details: Wolfson Conference Centre, Hammersmith Hospital, Du Cane Road, London W12 ONN, UK. Tel (+44) (0)20 8338 3117/3227/3245; Fax (+44) (0)20 8338 2428; e-mail wcc@ic.ac.uk

Diagnostic Histopathology of Breast Disease
16–17 June 2005, Royal College of Physicians, London, UK
Further details: ACP Central Office, 189 Dyke Road, Hove BN3 1TL, UK. Tel (+44) (0)1273 75700; e-mail info@pathologists.org.uk

Association of Clinical Pathologists’ National Scientific Meeting
26–29 July 2005, Royal Brompton Hospital, London, UK
Further details: Professor B Corrin, Brompton Hospital, London SW1 6NP, UK. Fax (+44) (0)20 7 351 8293; e-mail b.corrin@ic.ac.uk
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