Presentation and outcome of rhino-orbital-cerebral mucormycosis in patients with diabetes

A Bhansali, S Bhadada, A Sharma, V Suresh, A Gupta, P Singh, A Chakarbari, R J Dash

Aim: To report presentation and outcome of rhino-orbital-cerebral mucormycosis (ROCM) exclusively in patients with diabetes mellitus.

Methods: Retrospective, non-comparative, interventional analysis of the medical records of 35 patients with ROCM among 22316 patients with diabetes seen over the last 12 years. Nine patients had ROCM as the first clinical manifestation of diabetes. The mean (SD) blood glucose at presentation was 20.6 (8.3) mmol/l (range 10.0 to 53.3 mmol/l) and 17 patients had ketosis/ketoacidosis. Ophthalmic symptoms and signs were pronounced: external ophthalmoplegia (89%), proptosis (83%), visual loss (80%), chemosis (74%), and eye lid gangrene (14%). Non-ophthalmic manifestations included sinusitis (100%), nasal discharge/ulceration (74%), infranuclear VI nerve palsy (46%), palatal necrosis (29%), cerebral lobe involvement (20%), and hemiparesis (17%).

Conclusions: In patients with diabetes and ROCM, ROCM was the presenting manifestation in one fourth and treatment (p < 0.05), facial and/or eye lid gangrene (p < 0.05), and treatment with amphotericin B alone (p < 0.05).

RESULTS
The overall prevalence of ROCM with diabetes was 0.15%. Thirty one patients had clinical features of ROCM at presentation, and four developed it during the hospital stay. The diagnosis of ROCM was suspected in only three (8.6%).
patients before admission to our centre. The lag time between onset of symptoms referable to mucormycosis and the start of amphotericin B ranged from three to 45 days with mean (SD) of 13.8 (10.3) days. The mean (SD) blood glucose at presentation was 20.6 (8.3) mmol/l with a range of 10.0–53.3 mmol/l. Five patients had diabetic ketoacidosis (blood glucose >13.8 mmol/l, ketonuria, pH <7.3, and bicarbonate <15 mmol/l) and 12 had ketosis (blood glucose >13.8 mmol/l, ketonuria, pH >7.3, bicarbonate >15 mmol/l). One patient had hyperosmolar non-ketotic coma with a serum osmolality of 326 mosmol/kg and had acidosis caused by acute renal failure. Two patients were hypertensive: one had dilated cardiomyopathy and other had recent anterior wall myocardial infarction.

Clinical features of these patients are summarised in tables 1 and 2. Eight patients had onset of their disease with toothache with one developing submandibular abscess later, one with otitis externa and perichondritis followed by ophthalmoplegia, and one with catarrh. Eight (29%) patients had altered sensorium at presentation, while two others developed it during their hospital stay, one due to internal carotid artery occlusion, and the other due to hydrocephalus. Ophthalmoplegia (89%) was the most frequent presentation followed by proptosis (83%). Visual loss (80%) was observed in 26 patients at presentation and two patients developed it during their hospital stay. One patient had bilateral proptosis, ophthalmoplegia, and visual loss.

On computed tomography/magnetic resonance imaging, all patients had evidence of paranasal sinuses involvement. The ethmoid (86%) and maxillary sinuses (80%) were most commonly involved, followed by sphenoid and frontal sinuses in six (17%) each and pansinusitis in five (14%) (fig 1A). Two patients had a gas shadow over the maxilla suggestive of mycetoma. The ethmoid and maxillary sinuses or via the nasolacrimal duct.10 ROCM typically originates in the nasal or oral mucosa, and then extends through mucosal blood vessels to involve the adjacent structures.10,11 Intracranial extension may occur from the orbit via orbital apex, orbital vessels, or via cribriform plate.10,11 Diabetes predisposes to this infection, as is seen in the majority of instances of ROCM (60%–81%) in different series.1,2,5,10,11 Ketoacidosis in diabetes offers an added advantage to this

### Table 1 Frequency of ophthalmic signs and symptoms; values are percent

<table>
<thead>
<tr>
<th>Clinical presentation</th>
<th>Present study (n = 35)</th>
<th>Yohai et al (n = 88)</th>
<th>Ferry et al (n = 16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ophthalmoplegia</td>
<td>89</td>
<td>67</td>
<td>60</td>
</tr>
<tr>
<td>Proptosis</td>
<td>83</td>
<td>64</td>
<td>13</td>
</tr>
<tr>
<td>Loss of vision</td>
<td>80</td>
<td>65</td>
<td>25</td>
</tr>
<tr>
<td>Chemosis</td>
<td>74</td>
<td>24</td>
<td>–</td>
</tr>
<tr>
<td>Periorbital swelling</td>
<td>66</td>
<td>43</td>
<td>–</td>
</tr>
<tr>
<td>Periorbital pain</td>
<td>43</td>
<td>11</td>
<td>38</td>
</tr>
<tr>
<td>Eyelid necrosis</td>
<td>14</td>
<td>11</td>
<td>–</td>
</tr>
<tr>
<td>CRAO</td>
<td>20</td>
<td>16</td>
<td>–</td>
</tr>
<tr>
<td>Endophthalmitis</td>
<td>6</td>
<td>1</td>
<td>–</td>
</tr>
</tbody>
</table>

**CRAO**, central retinal artery occlusion.

### DISCUSSION

Disseminated cutaneous mucormycosis typically originates in the nasal or oral mucosa, spreads to the paranasal sinuses, and enters the orbit via the ethmoid and maxillary sinuses or via the nasolacrimal duct.10 ROCM typically originates in the nasal or oral mucosa, spreads to the paranasal sinuses, and enters the orbit via the ethmoid and maxillary sinuses or via the nasolacrimal duct.10 Intracranial extension may occur from the orbit via orbital apex, orbital vessels, or via cribriform plate.10,11 Diabetes predisposes to this infection, as is seen in the majority of instances of ROCM (60%–81%) in different series.1,2,5,10,11 Ketoacidosis in diabetes offers an added advantage to this
fungal invasion, as is seen in half of our patients.12 The acidic milieu reduces the binding of iron to transferrin, thereby more free iron and lack of a dialysable inhibitory factor in patients with diabetes offer favourable conditions for fungal multiplication.13

Yohai et al reviewed 145 case reports of ROCM, 60% of them had diabetes, and analysed their ophthalmic and non-ophthalmic signs and symptoms occurring at any time during the course of disease.1 Similarly Ferry and Abedi reported 16 cases of ROCM; 13 (81%) of them had diabetes.2 We have compared our observations with these two available series where the majority of the patients had diabetes.

Periorbital swelling and pain were observed in 66% and 43% of patients by us, compared with 43% and 11% respectively by Yohai et al.1 Ptosis in absence of ophthalmoplegia was reported in 3% of patients, whereas all our patients with ptosis had concomitant ophthalmoplegia. Ophthalmoplegia (89% v 67%) and proptosis (83% v 64%) were more frequently observed by us compared with others.1 These were attributed to direct infiltration of retro-orbital tissue in 25, cavernous sinus thrombosis in two, and two had both. Visual loss was observed in 80% of our patients, compared with 65% reported by Yohai et al1 and 25% by Ferry et al.2 It was attributed to central retinal artery occlusion in seven, endophthalmitis in two, cavernous sinus thrombosis in four, while in others orbital vascular involvement could have been the possible cause. Cavernous sinus thrombosis due to mucormycosis is typically associated with vision loss as was seen in all our patients. Endophthalmitis has been rarely reported (1%) with ROCM but in our series two (6%) patients had it.1 14 Overall it seems that orbital manifestations were more common in our patients than reported in the literature. This could be due to delay in admission, thereby permitting spread of infection to the orbital tissue. Orbital manifestations are due to ischaemic necrosis of the intracranial cranial nerves, orbital cellulitis, or rarely ocular invasion by mucorales.1

With regard to nasofacial and oral manifestations, our patients had more extensive involvement than reported by Yohai et al particularly with regard to facial swelling (46% v 30%), facial parasthesias (34% v 20%), nasal ulceration or necrosis (74% v 48%), palatal necrosis (29% v 32%), and infranuclear facial palsy (46% v 22%).1 Similarly, Ferry et al reported black eschar of skin, nasal mucosa, or palate in only 19% of their patients.2

The occurrence of central nervous system involvement in the form of brain abscesses involving the frontal and temporal lobes was observed in 20% of patients whereas Yohai et al reported this in 8% of their patients.3 However, altered sensorium (29%), hemiparesis (17%), and meningeal signs (11%) were comparable with others.1 It must be realised that if sensorium does not improve with normalisation of pH, anion gap and electrolytes in a patient with diabetic ketoacidosis, mucormycosis should be considered.4 Worsening of sensorium in a patient with established mucormycosis suggests cerebral invasion or a major vascular occlusion by mucorales.1 4 Of our two patients with sino-orbital mucormycosis who developed altered sensorium
rhinotomy, pansinusectomy, orbital exenteration, and sometimes intracranial surgery are performed depending upon the extent of the disease. Extensive orbital involvement by mucorales required orbital exenteration in 11 (42%) patients and nine (82%) of them survived. This is in concurrence with other observers who feel orbital exenteration may be life saving in an actively inflamed orbit with a blind, immobile eye.2 3

Factors associated with poor survival in ROCM include (i) delay in diagnosis and treatment, (ii) hemiparesis, (iii) bilateral sinus involvement, and (iv) facial necrosis.1 Yohai et al reported survival of 63% of patients with a lag time from seven to 12 days and 44% in those with a lag time of 13 to 30 days.4 In our analysis, 85% patients survived who had lag time from three to nine days, but only 55% survived with a lag time of 10 to 45 days. Similarly, those with hemiplegia, facial/eye lid gangrene, and cerebral invasion by mucorales had a poor survival in our series as also reported by Yohai et al.1 Patients who received surgical treatment in addition to amphotericin B had a better outcome than those who received amphotericin B alone. This is in agreement with observations made by others.5–7 However, survival outcome was not affected by the presence of ketoacidosis in our study, possibly because of extensive disease and late presentation. However, our survival rate was comparable to that reported in western countries (68% v 70%–73%) in different series.1 4 5 10

In conclusion, our patients with ROCM exhibited more extensive ophthalmic and cerebral involvement compared with their western counterparts, probably because of late presentation. Delay in treatment and associated complications were major predictors of survival outcome.

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REFERENCES

IMAGES IN MEDICINE

Pre-aortic paraganglioma

A 49 year old man with chronic headaches, longstanding anxiety, and fatigue presented with poorly controlled hypertension. Type 2 diabetes had been diagnosed recently. There was no history of palpitations, flushing, or chest pain; blood pressure was 170/100 mm Hg. Physical examination was otherwise normal.

His history prompted the measurement of urine catecholamines. Urine metadrenaline was raised at 85.6 μmol/24 hours (normal 0–5.5) and urine noradrenaline was markedly raised at 15388 μmol/24 hours (normal 90–600); urine dopamine and adrenaline were normal. I131MIBG scintigraphy showed increased isotope uptake in the epigastric area (arrow, fig 1). Abdominal computed tomography showed a lobulated mass in the region of the left coeliac axis (arrow, fig 2). A large vascular pre-aortic phaeochromocytoma was subsequently removed. Blood pressure and glucose tolerance normalised after surgery.

Phaeochromocytomas are rare tumours accounting for fewer than 1% of cases of hypertension. Extra-adrenal tumours termed paragangliomas occur in 10% of patients and arise from neural crest derivatives. They predominantly secrete noradrenaline. Phaeochromocytomas occur equally in both sexes and usually present in the third and fourth decades of life. Ninety percent of tumours are sporadic, while 10% occur as part of an inherited syndrome like multiple endocrine neoplasia type 2, Von Hippel-Lindau syndrome, or neurofibromatosis.

In the absence of classical paroxysms, the symptoms of catecholamine excess may be protean and non-specific. A high index of suspicion remains the cornerstone of diagnosis.

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Figure 1 Scintigraphy showing increased isotope uptake in epigastric area.

Figure 2 Abdominal computed tomography showing lobulated mass in the region of the left coeliac axis.