CASE REPORTS

Chickenpox pneumonia: case report and literature review

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Abstract

The incidence of primary chickenpox infection in young adults appears to be rising in the UK and other developed countries. The infection is more severe in adults than in children and complications, including pneumonia, are more frequent. An illustrative case of severe chickenpox pneumonia in an immunocompetent, non-pregnant adult smoker is presented. The epidemiology and pathology of the disease is discussed and a review of current management in the emergency department and the intensive care unit is presented. Strategies for the prevention of chickenpox pneumonia are also discussed. (J Accid Emerg Med 1999;16:147-150)

Keywords: chickenpox pneumonia; emergency management; critical care

Case report

A 27 year old, non-pregnant, female smoker self referred to the emergency department in February 1998. Her two young children had developed chickenpox a few days earlier. The patient herself was previously well with no recollection of having had chickenpox in the past. She had noted a diffuse rash on her upper body for two days before attendance and a dry cough and breathlessness for one day.

On examination she looked flushed and unwell with a characteristic varicelliform rash over the face, neck, and torso. She was pyrexial (temperature 37.8°C) and tachypnoeic (respiratory rate 34 breaths/min). Fine inspiratory crackles were audible over the lung bases and arterial blood gases on air revealed type I respiratory failure (pH 7.38; arterial carbon dioxide tension 4.52 kPa; arterial oxygen tension 2 7.5 kPa; bicarbonate 20.1 mmol/l; oxygen saturation 88.8%). The chest radiograph showed bilateral noduloreticular shadowing predominantly affecting the lower zones (fig 1).

A diagnosis of chickenpox pneumonia was made and she was admitted to the critical care unit where she was treated with high flow oxygen by facemask and intravenous aciclovir 10 mg/kg eight hourly. She failed to improve over the next few hours and so was electively intubated with thiopentone and suxamethonium. Intermittent positive pressure ventilation was instituted, the ventilator set to deliver a

Figure 1 Initial chest radiograph of subject showing bilateral interstitial and alveolar shadowing with apical sparing.

tidal volume of 400 ml at 12 breaths/min with 5 cm of positive end expiratory pressure (PEEP). Compliance was maintained with propofol, diamorphine, and atracurium. Infusions of frusemide and human albumin solution were started to treat pulmonary oedema. Packed red blood cells were transfused to maintain haemoglobin concentration and improve oxygen delivery.

Haemophilus influenzae and coliform species were isolated from tracheal aspirates on day 3 and pseudomonas species on day 5. Blood cultures and intravascular catheter tips grew coagulase negative staphylococci on days 4, 7, and 10. Antibiotics were prescribed according to sensitivities. The platelet count was $90 \times 10^9/l$ on admission falling to $50 \times 10^9/l$ on day 4 before recovering. There were no bleeding complications. There was a modest rise in hepatic transaminases but the plasma sodium remained normal throughout. There was no evidence of circulatory failure or renal impairment at any time.

She remained severely ill during the next nine days with high fever and fractional inspiratory oxygen requirements of 0.9-1.0 in spite of prone ventilation. A spontaneous right pneumothorax occurred on day 7 which was treated

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with tube thoracostomy. Her condition began to improve on day 10 with defervescence and improved gas exchange. Atracurium was discontinued on day 12 and she received a tracheostomy on day 14. Sedation was discontinued on day 15 and she weaned successfully via a T piece. She was decannulated and transferred to a general ward on day 20 and discharged home on day 28. At outpatient review five weeks after admission she was clinically well despite a significant restrictive lung impairment on spirometry (forced expiratory volume in one second 1.3 l; forced vital capacity 1.6 l).

Discussion

Varicella zoster virus is classified as an alphaherpes virus and is morphologically identical to herpes simplex virus on electron microscopy. The mature particle is a 150–200 nm diameter sphere with an inner core of double stranded DNA. Chickenpox is the primary infection and a common exanthem of childhood. It is highly prevalent in temperate climates and the majority of the population are exposed between the ages of 2 and 7 years, often in the late winter or early spring. Fewer than 10% of children avoid the infection before adolescence.

Chickenpox is spread by nasopharyngeal droplets, less commonly by contact with vesicle fluid from cases of chickenpox or shingles. The disease is contagious from a day or two before the development of the rash until 48 hours after the last vesicles have encrusted. The primary infection is usually mild and symptoms last no more than seven days in most cases. Infection is usually followed by lifelong complete immunity. Antibody levels vary, however, and there are examples of a second primary infection occurring in the same individual.¹

There is some evidence of an age specific rise in the incidence of chickenpox in the UK with more cases being reported in young adults.² Although fewer than 2% of chickenpox cases occur in adults, the disease is more severe. Infected individuals over the age of 20 years are 25 times more likely to develop complications including pneumonia.^{3–4} Increased mortality from chickenpox in adults in this country was reported in 1988 and 1996.^{5–6} Individuals with immunosuppression, pregnant women, and immigrants from areas of low seroprevalence are at particular risk. The incidence of pneumonia among pregnant women with chickenpox may be as high as 40% and is usually severe.⁷ Most reported cases of varicella pneumonia have occurred in cigarette smokers.^{3–8–9} Smokers are at increased risk because of underlying damage to alveolar macrophages.¹⁰

CHICKENPOX PNEUMONIA: PATHOLOGY AND EPIDEMIOLOGY

Varicella pneumonia was first described in 1942 and is the most common and most serious complication of chickenpox in adults.¹¹ Pulmonary infection with varicella produces a widely disseminated interstitial pneumonitis with patchy haemorrhagic consolidation. Fibrinoid necrosis and septal oedema are apparent

in histological specimens and the alveoli are full of proteinaceous fluid containing red cells and mononuclears. Neutrophil infiltrates are also seen and are non-specific features of acute lung injury but secondary bacterial infection, especially with *H influenzae*, is common.

Varicella pneumonia is not a notifiable disease and the true incidence in the UK is unknown, however one study from Stockholm estimated an annual incidence of 0.32 per 100 000 of the population.¹² Extrapolating this figure to the UK one might expect one case of varicella pneumonia to present to the average district general hospital each year. Thirteen patients with varicella pneumonia were admitted to a hospital serving Wandsworth Health Authority (population 300 000) during a 10 year period.¹³ Four cases, including the subject of this report, have been treated at the present authors' hospital during the past three years. All were adult smokers and all presented in January or February.

Pulmonary involvement in primary varicella infection presents a variable spectrum of severity with some mild cases never seeking medical attention. In a US military establishment 16% of young adults with chickenpox had abnormal chest radiographs, though not all required inpatient treatment.¹⁴ In another review of 130 adults attending an urban emergency department with chickenpox there were 13 cases with respiratory symptoms of whom only six were hospitalised.¹⁵ Varicella pneumonia is relatively rare in immunocompetent children with a reported incidence of 0.8 to 14% in those who are admitted to hospital with chickenpox complications.¹⁶

The outcome from varicella pneumonia depends upon the severity of the disease, the immune state of the patient, and comorbid factors including pregnancy. Antiviral treatments, available since the early 1980s, may also affect the prognosis. Overall the mortality rate for the disease in the post-aciclovir era should be around 10% in pregnant and non-pregnant individuals.^{13–17} Nineteen deaths per year due to varicella pneumonia are reported annually in England and Wales.⁵

CLINICAL FEATURES

Adult patients with varicella pneumonia present with fever, dyspnoea and dry cough, sometimes with mild haemoptysis. There may be chest pain or discomfort over the trachea. Exposure to chickenpox through one's own children is typical. On examination there is pyrexia with tachypnoea and fine crackles on auscultation over the lower lung fields. The characteristic skin lesions are inevitably present since respiratory symptoms usually onset two to five days after the appearance of the rash, only rarely preceding the eruption. Vesicles are usually present on the palate and are apparent in the upper respiratory tract on laryngoscopy. Arterial blood gases show evidence of type I respiratory failure with hypoxaemia and normocapnoea. Routine haematological and biochemical estimations often

reveal a moderate thrombocytopenia, hyponatraemia, and raised hepatic transaminases.

The chest radiograph shows a diffuse noduloreticular infiltration with apical sparing, the nodules may coalesce to areas of consolidation. The extent of the radiological abnormalities does not correlate well with the severity of the clinical illness but does seem to reflect the diffuseness of the skin rash.¹⁸ Additional radiographic features may include pleural effusions and hilar adenopathy. Pneumothorax is an uncommon finding on early assessment. The findings on chest radiography may take several weeks to return to normal with nodules of soft tissue density sometimes persisting for years. Rarely the nodules may calcify, not before two years, which accounts for the occasional incidental finding of "chickenpox lung" on routine radiographs in adults.¹⁹

The diagnosis of chickenpox is usually clinically obvious in patients presenting with respiratory complications. Confirmatory tests, rarely required, include the presence of giant cells in vesicle fluid, direct demonstration of the virus by electron microscopy (which does not distinguish between varicella zoster virus and herpes simplex virus) and immunofluorescent antibody titres in paired sera. In complicated cases transbronchial lung biopsy may be carried out as well as bronchoalveolar lavage, which demonstrates increased total lymphocyte counts and reduced CD4:CD8 ratios where there is lung involvement.

TREATMENT

Varicella pneumonia should be suspected in any patient presenting to the emergency department with the characteristic rash and any respiratory symptoms. High flow oxygen by mask should be administered as soon as possible where symptoms are significant. A chest radiograph should be ordered in all cases. Blood samples should be drawn for platelet count, plasma sodium, amylase, renal chemistry, and liver function tests. Arterial blood gases will determine the degree of hypoxaemia. The patient should be admitted to a critical care area for observation and pulse oximetry. Options for the treatment of persistent respiratory failure include continuous positive airway pressure (CPAP) or biphasic positive airway pressure (BiPAP) via facemask and elective intubation and positive pressure ventilation with PEEP. In a 10 year series of 15 cases of varicella pneumonia reported from Cape Town eight received facemask CPAP and four were ventilated, three patients recovered with facemask oxygen alone. Respiratory rate on admission may be a useful predictor of the need for respiratory support.¹⁷ CPAP by mask is a useful modality which avoids the complications of tracheal intubation but it requires a good cough, good alveolar ventilation (normal carbon dioxide), and a compliant patient who can tolerate the tight fitting mask. BiPAP systems are recent modifications which, in addition to PEEP, also deliver inspiratory pressure support.

In intubated, ventilated patients requiring high levels of PEEP high inflation pressures

may cause barotrauma and worsening of the lung injury. Ventilator protocols are directed at limiting peak inspiratory pressures even in the presence of moderate hypoxia and hypercarbia. Inverse I:E ratio and pressure controlled modalities are often employed and the patient may be nursed prone to improve diaphragmatic function and optimise V/Q matching.

Extracorporeal membrane oxygenation (ECMO; extracorporeal life support, ECLS) was developed for use in neonates but has occasionally been used in severe pneumonia in adults, including varicella pneumonia. The largest series of ECLS in varicella pneumonia in the literature reported just seven patients, all with critical respiratory failure not responding to conventional ventilation, of whom five survived to discharge.²⁰

Early tracheostomy (within seven days after intubation) has been shown by some authors to be beneficial in patients ventilated for respiratory failure,²¹ while others have failed to demonstrate any advantage.²² There are practical reasons for early tracheostomy in patients referred for ECMO since the procedure may be more difficult in the presence of anticoagulation.

Up to 50% of patients with varicella pneumonia in the critical care unit are likely to develop secondary bacterial infection. Coagulase negative staphylococci and group A streptococci frequently colonise the skin and invasive lines and tracheal aspirate will often yield a growth of haemophilus, coliforms, and pseudomonas species. Antimicrobials are indicated according to the patient's clinical condition and the results of bacteriological surveillance. Chlorhexidine applied topically may reduce skin colonisation with Gram positive organisms.

Corticosteroids are said by some authorities to be contraindicated,²³ while others have reported a good response to steroid treatment in varicella pneumonia.¹²

Aciclovir is an inhibitor of DNA polymerase, which was initially used specifically for the treatment of herpes simplex infections. It is less effective against varicella but recent reports have demonstrated the value of this drug in reducing mortality in complicated chickenpox in immunocompromised adults,⁴ immunocompetent adults,¹⁷ and in pregnancy.²⁴ The therapeutic dose in serious infections is 5–10 mg/kg intravenously eight hourly for at least seven days. A regimen of 5 mg/kg produces peak plasma levels of 10 mg/l in most subjects, falling to 0.7mg/l by eight hours. Varicella zoster virus is less sensitive to the drug than herpes simplex virus but varicella is inhibited by concentrations of 0.08 to 1.2 mg/l.^{25–26} The dose is reduced in renal impairment because of the potential for nephrotoxicity. Other side effects include phlebitis at the infusion site, neurological dysfunction, and increase of the hepatic transaminases. Aciclovir may be used in pregnancy; the therapeutic benefit of treating varicella pneumonia outweighs the risk of embryopathy.²⁷

PREVENTION

The US National Center for Infectious Diseases received reports of three adult deaths due to chickenpox in the first three months of 1997, including two cases of pneumonia in previously healthy non-pregnant adults.²⁸ Three control strategies were recommended, including universal vaccination against varicella in children aged over 12 months and non-immune adults, after antibody testing in doubtful cases. The vaccine was developed in Japan in 1972 and has been available in North America since March 1995. It is a live, attenuated virus preparation and therefore is unsuitable for immunosuppressed persons and pregnant women. Uptake of the vaccine has been poor even in designated US surveillance sites because of perceptions that chickenpox is mild and usually uncomplicated and unjustified concerns over the efficacy and duration of immunity afforded by vaccination. Other reasons advanced to account for poor "hit rates" are the stringent storage and handling regulations and matters of cost. Varicella is not included in currently available vaccination schedules in the UK.

The second strategy concerns varicella zoster immune globulin (VZIG). It is available for post-exposure prophylaxis in susceptible individuals including pregnant women and immunosuppressed persons and may be prescribed, on the advice of specialists in infectious disease, to non-immune health care workers who may present to the emergency department after occupational exposure to a case of chickenpox. VZIG should be given as soon as possible but it may be effective up to 96 hours after exposure.

Finally, it was recommended that all adult cases of chickenpox should be treated with oral aciclovir, preferably within 24 hours of the development of the rash.

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Management of laryngeal foreign bodies in children

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Abstract

Foreign body aspiration is one of the leading causes of accidental death in children. Food items are the most common items aspirated in infants and toddlers, whereas older children are more likely to aspirate non-food items. Laryngeal impaction of a foreign body is very rare as most aspirated foreign bodies pass through the laryngeal inlet and get lodged lower down in the airway. Two rare cases of foreign body

aspiration with subglottic impaction in very young children (under 2 years of age) are described. In both the cases subglottic impaction occurred consequent to attempted removal of foreign body by blind finger sweeping. The clinical presentation, investigations, and management of these rare cases are discussed.

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