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Post-measles pneumomediastinum and subcutaneous emphysema in malnourished children

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Summary

One hundred and seventy-two children with complicated measles were studied clinically and radiologically for the presence of post-measles pneumomediastinum and subcutaneous emphysema. Eleven cases (6.4%) were found to have this complication. Protein energy malnutrition was an association in 81.8% of these patients. The condition was severe and fatal in one patient, while emergency tracheostomy was needed in another patient who had upper air way obstruction due to gross subcutaneous emphysema. We suggest close observation and early intervention in patients with severe and rapidly progressive subcutaneous emphysema, pneumomediastinum, air block and whenever there is a jeopardy to the cardiovascular system.

Keywords: Measles, subcutaneous emphysema, pneumomediastinum, malnutrition

Résumé

172 enfants ayant larougede avec des complications ont ete etudies cliniquement et radiologiquement pour l presence post-rougeole du pneumomediastinum et l'emphysema sous-cutanee. 11 cas (6,4%) avaient cette complication. La malnutrition energiee - proteine etait en association dans 81,8% de us patients. La condition etait severe et meme fatale chez l'un des mulades pendant que la trachestomie etait necessaire chez un autre qui avait une obstruction de la trachee artere superieure causee par l'emphysema sous-untainee enorme. Nous suggirons une observation de pres et une intervention premiere chez les maladies ayants: L'emphysema sous - cutanee severe et progressant rapidement, le pneumomediastinum, le blocage de la trachee artere et chague fois que le systeme cardio-vasculaire est en danger.

Introduction

During measles infection, the violent cough associated with "alveolar enanthen" and peribronchial inflammatory changes create a pressure gradient between the alveolar space and the surrounding structure. Alveoli may then rupture and air leaks into the perivascular interstitium dissecting proximally within the bronchovascular sheath towards the mediastinum. Thence, air decompresses into the cervical subcutaneous tissue through the conduit formed by the deep fascia investing the trachea and esophagus [1].

Abrupt rise in the mediastinal pressure might also lead to rupture of the parietal pleura, giving rise to pneumothorax. Furthermore, air passing through fascial planes may extend to the arms, chest wall, abdominal wall, lower limbs and genitalia.

We have studied 172 children with complicated measles (PM). The objective of this study was to highlight the magnitude of the problem, its complications and management. The potentially lethal complications that arose and the importance of close observation and well-timed intervention are elucidated.

Patient and methods

The study group included 172 patients that presented all children with complicated measles admitted to the paediatric wards

in Omdurman Teaching Hospital during the famine period in Sudan (1984-1985). Complications of measles included protein-energy malnutrition, bronchopneumonia, gastroenteritis, skin infection, eye infection and pulmonary tuberculosis. All patients were coming from a temporary settlement camp set for famine-driven immigrants. All patients were subjected to careful clinical examination for the presence of subcutaneous emphysema where the diagnosis was based on the observation of a subcutaneous swelling, palpation of a crackle over it and confirmation of the presence of aberrant air radiologically. Diagnosis of air in other compartments, e.g., mediastinum, paracardiac area, pleura and lung interstitium, depended upon the clinical as well as the radiological findings. All patients found to have one or more of these complications, were followed up clinically and radiologically. Specific treatment to relieve the pressure of aberrant air on vital organs was dictated by the condition of the patient.

Results

A total of 172 children (94 males and 78 females) were admitted to the paediatric wards in Omdurman Teaching Hospital with complicated measles that included protein-energy malnutrition, bronchopneumonia, gastroenteritis, skin infections and pulmonary tuberculosis (Table 1). Eleven patients (6.4%), 7 males and 4 females, developed subcutaneous emphysema.

Table 1: Complications associated with measles in 172 patients

Complication	No (%)
Marasmus	102 (59.3%)
Bronchopneumonia	97 (56.4%)
Gastroenteritis	43 (25%)
Conjunctivitis	35 (20.3%)
Marasmic kwashiorkor	31 (18%)
Kwashiorkor	19 (11%)
Mouth ulcers	18 (10.5%)
Skin infections	11 (6.4%)
Subcutaneous Emphysema	11 (6.4%)
Under-nutrition	1 (0.6%)
Pulmonary tuberculosis	1 (0.6%)
Convulsions	1 (0.6%)

Table 2: Age and sex distribution of patient with PM and SCHEM

Age group (yrs)	Male	Female	Total
1 - 3	2	2	4
>3 - 6	3	1	4
>6 - 9	1	0	1
>9 - 12	1	1	2
Total	7	4	11

Table 3: Clinical and radiological feature of patient with post-measles SCEM: Various Authors

Author	No.	Age	Male	Female	Incidence	Malnourished (%)	Pulmonary Infiltrate	Interval Rash to SCEM (days)	Resolution Time (days)
Singh [7]	40	6mo- 5yr	21	19	1.9%	65%	100%	5 - 7	15
Odita [11]	17	11mo- 2yr	7	10	1%	**	100%	4 - 9	14
Gilmartin [2]	7	3 - 8yr	**	**	0.3%	**	14.3%	1 - 7	18
Yalaburgi [5]	4	11-18 mon	1	3	0.59%	50%	100%	6 - 7	14
Sharma [9]	1	3 yr	1		**	100%	100%	7	14
Crosse [10]	1	6 yr	1		**	**	100%	4	14
Present study	11	1 - 12 yr	7	4	6.4%	81.8%	100%	8	11

** : No mention

Age of patients with SCEM ranged from one year to 12 years, 8 of them were above 6 years (Table 2). Nine patients (81.8%) with SCEM weighed less than 80% of Harvard's Reference Standards for their age. One of the 9 patients was severely marasmic while four (36.4%) had florid kwashiorkor. The mean duration between onset of measles rash and appearance of SCEM was 8 days and the mean duration to complete resolution of SCEM was 11 days (Table 3).

Table 4: Radiological features of patients with clinical post-measles SCEM.

X-ray findings	No.
SCEM	11 (100%)
Pulmonary infiltrate	11 (100%)
Pneumomediastinum	8 (72.7%)
Pneumothorax	2 (18.2%)
Retrosternal air	1 (9.1%)
Paraspinal air	1 (9.1%)
Pneumatocoele	1 (9.1%)
Air trapping in Alveoli	1 (9.1%)

On X-ray, SCEM and pulmonary infiltrate (Fig.2) were seen in 11 patients (Table 4). Pneumomediastinum was the next most common feature seen in 8 patients (73%). Two patients (18.2%) developed pneumothorax and one had air trapping in alveoli. A three year old boy needed an emergency tracheostomy for an upper air way obstruction caused by gross SCEM of the neck and face. One patient needed thoracotomy and an under-water seal to relieve pneumothorax. Two patients died (18.2%). The first one was a marasmic, 2 year old girl who developed gastroenteritis and severe dehydration. The second one was a four year old boy who developed extensive SCEM down to the genitalia. He collapsed suddenly after an attack of chest pain and breathlessness. Postmortem examination could not be accredited. Two boys, age 3 and 12 years; and a 10-year-old girl developed hair-on-end appearance following gross cervical and facial SCEM. A marasmic female child with extensive pulmonary infiltrate and a positive sputum test for AFB was put to antituberculous treatment.

Discussion

Post-measles pneumomediastinum and subcutaneous emphysema develop as a consequence of the pressure gradient generated by severe cough and the partial airway obstruction caused

by the inflammatory process in alveoli (alveolar enanthem), tiny bronchi and peribronchial tissue. As a result, alveoli may rupture leading to direct introduction of air into the bronchovascular sheath and thence, through fascial planes, upwards to the neck and trunk. Although PM and SCEM are considered rare complications of measles, a review of the literature back to 1910 revealed well-documented cases [2]. Pneumomediastinum may also arise following infection with gas forming organisms, pertussis, direct trauma to the lungs, mediastinum or the esophagus, during dental surgery and spontaneously [3] [4]. By far, the commonest cause of PM and SCEM is barotrauma during the use of ventilators, lung function tests, air travel, mountain climbing, and Valsalva's maneuver.

In this study, we report an incidence of 6.4% in patients with complicated measles who were already exposed to the deleterious effects of protein-energy malnutrition on their immunity and as a factor augmenting the severity of measles [5]. The age group in our patients was higher than that of the previous reports [1], [5], [7], [9]. This could be attributed to the fact that children below one year of age could not survive the famine period and that most of the deaths among infants and young children of these immigrants was not reported to hospital. An important factor involved in the high case fatality rate among infants with PM is the anatomical difficulty that hampers escape of air from the mediastinum to the neck and subcutaneous tissue [6]. In all patients with SCEM, chest X-ray showed pulmonary infiltrate, an observation that agrees well with the previous reports and in the mean time confirms the importance of lung pathology in the pathogenesis of PM and SCEM. Singh reported 40 case with postmeasles SCEM out of 2044 patients who were admitted to hospital with complicated measles [7]. Sixty-five percent of his patients fell below 80% of Harvard's standard weight-for-age and there were no cases of kwashiorkor. In our series, 11 out of 172 patients with complicated measles developed PM and SCEM and kwashiorkor was seen in 4 of them as the process of malnutrition during the famine period was a prolonged one. In contrast to our study, the same author reported fatal cases of acute laryngotracheobronchitis and bronchiolitis. In our patients these conditions were not seen, probably due to the occurrence of the famine during the hot and dry season as well as the higher age group encountered in our patients. Pneumomediastinum was diagnosed radiologically. We found it difficult to elicit Hamman's sign [8] as most of our patients had roaring chests and crepitus under the skin of the chest wall. However, sudden severe chest pain associated with gross SCEM was seen in one patient who succumbed in spite of all efforts to salvage him. That was probably a case of severe and rapidly progressive pneu-

momediastinum that was pressing on the heart, great vessels and the air way. Unfortunately, postmortem examination could not be accredited. The mean interval between onset of measles rash and the appearance of SCEM was 8 days and resolution time was 11 days. These findings are consistent with the previous reports [9] [10] [11]. Emergency tracheostomy as indicated by our study is a life-saving procedure in cases of PM and SCEM with acute upper air way obstruction. Vigilance on aseptic technique and post operative cleaning is of paramount importance to guard against possible complications, e.g., pneumonia and toxemia. An interesting observation was the hair-on-end appearance seen in some of these patients who developed gross cervical and facial SCEM. It was not very clear to us whether that was a feature of apprehension or a sign of local stretch on the erector pilae muscles.

Though spontaneous recovery occurs in most cases of PM and SCEM, we advise close observation and early surgical intervention in cases of rapid and progressive PM, SCEM, tension pneumothorax, air block and jeopardy to the cardiovascular system.

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