TABLE 1. Detection of Influenza Virus in NPW, Stool and Blood Specimens by Culture and PCR From Children (N = 20)

	Nasal Wash (n = 35)	Stool (n = 29)	Blood (n = 10)	Total (n = 74)
Cultures done	35	29	N/A	64
Influenza isolated	10 (28.6%, 6*)	0	N/A	10 (13.5%, 6*)
PCR done	35	29	10	74
PCR positive	32 (91.4%, 19*)	8† (27.9%, 5*)	1‡ (10%)	41 (55.4%, 19*)

*Number of discrete patients.
†8 (100%) 2009 nH1N1.
‡1 (100%) 2009 nH1N1.
PCR indicates polymerase chain reaction; N/A, not applicable.

6 (30%) were admitted to the pediatric intensive care unit with 2 (33.3%) having GI symptoms. Like that in Bhat report, only 3 of the 18 vaccine eligible children in our study had received age-appropriate vaccination.

We detected influenza in both nonrespiratory sites studied, stool and blood. Detecting influenza RNA in stool has previously been reported[6,7] with stool detection rates of up to 24.6%[6] and 47%.[7] Similar to our results, viral RNA positivity had little correlation with GI symptoms or outcome.[6,7] Unlike prior reports, fecal viral concentration in our study did not correlated with symptom duration.[7] This could have been related to our small sample size. Time from collection to storage would have been less likely to impact results as stool specimens were process more quickly for RNA-negative (26.0 hours [range 0.2–69]) versus RNA-positive (41.6 [2–72]) samples. We were not able to isolated live influenza virus from stool. This may have been related to the low inoculum or dilution effect inherent in stool samples. This is supported by the high Ct values detected in 7 of 8 qPCR-positive stool samples.

To our knowledge, we report the first case of nH1N1 viremia in an immunocompentent child. Viremia with seasonal influenza has been rarely reported. In contrast, viremia with nH1N1 has been reported in the blood of patients with severe infection[8] and among immunocompromised patients[9] using serum or plasma. Animal models have suggested red blood cell, such as we used in our study, to be a more successful target for polymerase chain reaction.[10] Our enrollment period (January 2009 to April 2011) involved 3 influenza seasons; however, only children with nH1N1 had viral RNA detected in nonrespiratory sites. Thus, our clinical and laboratory findings may be more reflective of the nH1N1 pandemic virus, highlighting perhaps a difference in cell tropism between seasonal and nH1N1 influenza.

In conclusion, we detected viral RNA in respiratory and nonrespiratory sites among immunocompetent children. Influenza RNA in stool was not associated with the presence of GI symptoms or more severe disease. Cultivable influenza viruses were not detected in stool; however, the presence of viral RNA raises infection control concerns. The finding of viremia in an immunocompetent child adds to the potential for systemic spread to nonrespiratory sites during influenza infection in children and adverse outcome.

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HIGH INCIDENCE OF SUBCUTANEOUS EMPHYSEMA IN CHILDREN IN A SOMALI REFUGEE CAMP DURING MEASLES OUTBREAK

Peter Moons, MD and Monica Thallinger, MD, DTMH

Abstract: During an outbreak of measles in a refugee camp in Ethiopia, 9 patients (age range 4 months to 18 years) were diagnosed with subcutaneous emphysema. Incidence of this rare complication of measles in this refugee camp was higher than previously reported. We hypothesize that the high incidence is most likely related to poor physical state of the refugee population with high rates of malnutrition

Key Words: measles/complications, subcutaneous emphysema, protein–energy malnutrition, child, child nutrition disorders/complications

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This case series met the requirements of the MSF ethical review board for retrospective review of routinely collected data.
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Address for correspondence: Peter Moons, MD, Médecins Sans Frontières, Plantage Middenlaan 14, P.O. Box 10014, 1001 EA Amsterdam. E-mail: petmoons@yahoo.com.

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Following years of escalating military conflict in Somalia, the United Nations declared a famine in several Somali regions in 2011. By that time, the population had already suffered for long

periods and large numbers of refugees had crossed the border into neighboring Ethiopia.

Médecins Sans Frontières (MSF) has provided independent medical aid in refugee camps in the area since 2008. Efforts have been made to administer routine vaccinations on arrival to the camps. Children less than 15 years of age are prioritized. With the sudden influx of refugees in 2011 operational constraints prevented adequate vaccine coverage in the first months of the response. People across all age groups had not been previously vaccinated. Due to the sheer number of refugees combined with the lack of "herd immunity," there was an outbreak of measles from August to October 2011.

We report 9 cases of subcutaneous emphysema treated in the Hiloweyn Refugee Camp. Subcutaneous emphysema is a well described but rare complication of measles. It is associated with malnutrition and can be fatal. The exact pathogenesis of this complication of measles is not known. It is postulated to result from rupture of alveoli because of increased intra-alveolar pressure. Air in the bronchiovascular sheet then travels through fascial planes to mediastinum and subcutaneous tissues. The hypothesis is that increased fragility of connective tissues due to both malnutrition and following the measles infection leads to the formation of bulla and pulmonary interstitial emphysema.[1] The incidence of emphysema in our population was higher than previously reported.

Patient Presentation

Between August and November 2011 a total of 237 cases of measles were registered. Nine cases of subcutaneous emphysema were diagnosed in patients who had all recently been diagnosed with measles. Clinical characteristics are summarized in Table 1. All cases were malnourished. Median age was 6 years (range 4 months to 18 years). Seven patients were male. Median duration from onset of rash to development of subcutaneous emphysema was 7 days (range 2–13 days). Four patients still had typical measles rash at presentation. Eight of the patients presented with fever. In all patients the initial respiratory symptom was cough. Three children had a hoarse voice. Subcutaneous emphysema typically started in the neck and spread thereafter to the thorax. In 3 patients there was extension to the abdomen and groin. Extension to the extremities and face occurred in 2 patients. Two patients showed signs of respiratory distress with clinical findings consistent with pneumothorax, pain over the affected lung, decreased air entry and increased percussion sounds. All patients were admitted to the inpatient facility and treated according to standard feeding protocol (including supplementation with vitamin A) depending on the degree of malnutrition. They received broad-spectrum antibiotics (ampicillin and gentamycin or ceftriaxone, some in combination with metronidazole). Cloxacillin and oxygen were initially not available in the camp, only the last patient was administered oxygen. Further supportive treatment was given by nasogastric tube feeding and analgesics for pain. In one patient dexamethasone was given.

Because all cases of measles in the camp were centrally reported (http://data.unhcr.org/horn-of-africa/country.php?id=65), incidence rates of subcutaneous emphysema in the camp could be calculated. The overall incidence in Hiloweyn camp was high (3.8%), but extremely high in the children younger than 5 years (15.4%). This complication was not unique to Hiloweyn camp. In the same time period 11 additional cases were seen at MSF clinics in other camps in the region (MSF-Operational Centre Barcelona, unpublished data).

Five patients survived and were discharged after a median of 10 days of inpatient treatment. At discharge no patient had signs of respiratory distress. Three patients had small amounts of subcutaneous emphysema. The median duration until resolution of the emphysema was 8 (range 5–14) days. Four patients died (case fatality rate 44%), all in severe respiratory distress. Death occurred within 24 hours in 1 case. The others died 2 or 3 days after presentation, 2 of whom had appeared relatively well before their condition suddenly deteriorated. It was suspected that tracheal compression may have played a role in their sudden deterioration.

DISCUSSION

Measles remains an important, potentially fatal childhood disease in all parts of the world where vaccination coverage is low.[2] It is an acute viral infection, which classically presents with a maculopapular rash and high fever. It is commonly associated with cough and may also be associated with conjunctivitis, otitis media, pneumonia and encephalitis. It is well recognized that the disease is usually more severe in malnourished children.

Subcutaneous and mediastinal emphysema is a rare but important complication. Case series report varying incidences from 0.59% to 1.5%.[1,3] It has most commonly been reported in children less than 5 years of age but also affects older children and adults.[4] Larger case studies report a male predominance[1,5,6] and emphasize an association with malnutrition, where 50–100% of patients affected were malnourished.[3,5,7,8] Emphysema can develop at any stage of the infection. It does not necessarily occur when measles exanthema is present (in 1 report only 30% of cases presented during the eruptive stage). The possibility of late presentation is therefore important for clinical practice as, due to the absence of rash, a relationship between the infection and subcutaneous emphysema may be missed.

All our patients had signs of pulmonary involvement (crepitations). We cannot report radiologic findings in our patients because there are no radiologic facilities in Hiloweyn camp. In setting where radiographs were available, radiologic evidence of infection in subcutaneous and mediastinal emphysema varied from

TABLE 1. Clinical Characteristics and Outcome of Cases

Case	Sex	Age	Level of Malnutrition*	Site Subcutaneous Emphysema	Outcome
1	M	14 yr	Moderate wasting	Neck, extending to chest wall	Survived
2	M	2 yr	Severe wasting	Neck, extending to chest wall	Survived
3	M	6 yr	Severe wasting	Neck, extending to left anterior chest wall and spreading down to scrotum	Died
4	M	15 yr	Moderate wasting	Neck	Died
5	F	18 yr	Moderate wasting	Neck, face (inability to open left eye because of extensive eyelid swelling), trunk up to hip level, arms up to fingers	Survived
6	M	4 mo	Severe wasting	Neck, extending to chest wall and oropharyngeal swelling	Survived
7	F	8 mo	Severe wasting	Neck	Died
8	M	15 yr	Severe wasting	Chest, abdomen, right arm, left shoulder	Survived
9	M	8 mo	Severe wasting	Neck	Died

*World Health Organization definitions and World Health Organization growth standards were used to express the level of malnutrition. Severe wasting: weight for height Z score <−3 or mid upper arm circumference <115 mm. Moderate wasting: weight for height Z score <−2 or mid upper arm circumference <125 mm.

TABLE 2. Case Fatality Rates in Different Settings (Only Case Reports of Which the Full Article Was Available Were Included)

Author	Country	Number of Cases	Case Fatality Rate (%)
Pene et al[1]	Ivory coast	46	41.3
Yalaburgi[3]	Botswana	4	50
Odita and Akamaguna[6]	Nigeria	17	5.8
Crosse[11]	UK	1	0
Sharma[8]	India	1	0
Khoo et al[12]	Malaysia	1	0
Sudhindra[13]	India	1	0
Swar et al[5]	Sudan	11	18.2

54% to 100% of cases.[1,5,9] Association of subcutaneous and mediastinal emphysema and pneumothorax varies from 4% to 75%.[1,9]

The differential diagnosis of subcutaneous emphysema includes pertussis, severe asthma, direct trauma, barotrauma, tuberculosis, as a complication of certain surgical procedures and infection with gas forming bacteria. We clinically excluded all of the potential etiologic factors above in each of our patients. Tuberculosis was not confirmed in any of our patients, but cannot be completely ruled out.

Subcutaneous emphysema is a rare complication of measles. Some large studies do not report any cases. Case series report incidence to vary up to 6.4% in a subpopupulation of children with complicated measles.[5] Incidence in our settings is high, most likely because of high rates of severe malnutrition in the camps.

Treatment of subcutaneous emphysema is mainly supportive. Because of high rates of pulmonary bacterial super infection, broad-spectrum antibiotics are generally recommended. Surgical interventions (drainage of pneumothorax and tracheostomy) have been performed successfully.[5]

Measles can lead to high case fatality rates especially when outbreaks occur in displaced populations.[10] The case fatality rates reported for subcutaneous emphysema are variable and are likely to be a reflection of resources available and have been reported to be as high as 50% (Table 2).

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COMMUNITY-ASSOCIATED *STAPHYLOCOCCUS AUREUS* INFECTIONS IN OTHERWISE HEALTHY INFANTS LESS THAN 60 DAYS OLD

Cecilia Torres Day, MD,† Sheldon L. Kaplan, MD,*‡ Edward O. Mason, PhD,*‡ and Kristina G. Hulten, PhD*‡*

Abstract: Community-associated (CA)-*Staphylococcus aureus* (CA-methicillin-resistant *S. aureus* in 57%) infections were reviewed in 179 infants (0–60 days) from June 2006 to June 2011. CA-MSSA accounted for 16 of 44 (36%) in year 1 up to 12 of 25 (48%) in year 5 ($P = 0.08$). Abscess/cellulitis infections were more likely ($P = 0.006$) to be caused by CA-methicillin-resistant *S. aureus* (67%) versus other manifestations of infections (46%). Among 160 isolates, 13% were clindamycin resistant and 63% were USA300.

Key Words: community-associated *Staphylococcus aureus*, neonates, infants, pustulosis

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From the *Department of Pediatrics, †Sections of Neonatology and ‡Infectious Diseases, Baylor College of Medicine, Texas Children's Hospital, Houston, TX.

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Address for correspondence: Cecilia Torres Day, MD, Texas Children's Hospital, Feigin Center, 1102 Bates Ave Ste 1150, Houston, TX 77030. E-mail: cday@bcm.edu.

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Staphylococcus aureus causes infections ranging from localized pustulosis to invasive cases in neonates and infants.[1] The emergence of community-associated (CA) methicillin-resistant *S. aureus* (MRSA) has complicated the diagnosis and management of *S. aureus* infections in this age group.[2,3]

We reviewed CA-*S. aureus* infections in healthy infants ≤60 days old at Texas Children's Hospital (TCH) from June 2006 to June 2011 to determine (1) if the proportion of CA-methicillin-susceptible *S. aureus* (MSSA) infections increased relative to infections caused by CA-MRSA as had been noted in older children at TCH after 2007,[4] (2) if any changes in diagnostic evaluations and management had occurred since our previous study on CA-*S. aureus* infections in neonates[5] and (3) the microbiologic and molecular characteristics of the associated CA-*S. aureus* isolate.

PATIENTS AND METHODS

Study Design and Patient Population

We identified from a prospective *S. aureus* surveillance study previously healthy infants ≤60 days old evaluated in the TCH Emergency Center (EC) and from whom *S. aureus* was isolated

