

## Background on HAPE

High altitude pulmonary edema (HAPE) is a type of non-cardiogenic pulmonary edema seen at higher altitudes generally above 2,500m to 3,000m and is usually associated with travel.<sup>1</sup>

Pediatric patients present with increased respiratory distress and tend to be afebrile, with temperatures no higher than 38.3C.<sup>2,3,4</sup>

There is an increased incidence of HAPE with underlying infections causing inflammation including upper respiratory infections, otitis media, and streptococcal pharyngitis.<sup>5</sup>

## Objective/Rationale

In our clinic and hospital that is located in Frisco, CO (elevation 2,800m above sea level), we frequently see resident pediatric patients without recent travel presenting with respiratory tract infections and severe hypoxia with symptoms compatible with HAPE.

Many of these children are diagnosed with pneumonia but have rapid and dramatic recovery with just high flow oxygen, without antibiotics. HAPE described in previous publications involve visitors to high altitude. In 1985, Fasules and colleagues published cases of HAPE in high altitude residents with no recent travel as well high altitude residents who developed HAPE after return from a lower elevation.<sup>6</sup> The diagnoses was made on the basis of cardiac catheterization done in Leadville at 3,080 m.

In our study, we identified three distinct types of HAPE: Classic, Reentry, and Resident.

## Methods

Medical records of 52 patients with suspected HAPE seen in 2015 at Ebert Family Clinic in Frisco, CO were reviewed. Patients studied lived in elevations between 2,440m to 3,500m. Medical records were accessed through the electronic medical record system, EPIC, which was used at both clinic and hospital. Key findings documented for this study were clinical symptoms, vital signs, images including chest x-rays, residency status, and number of days since arrival to higher elevation.

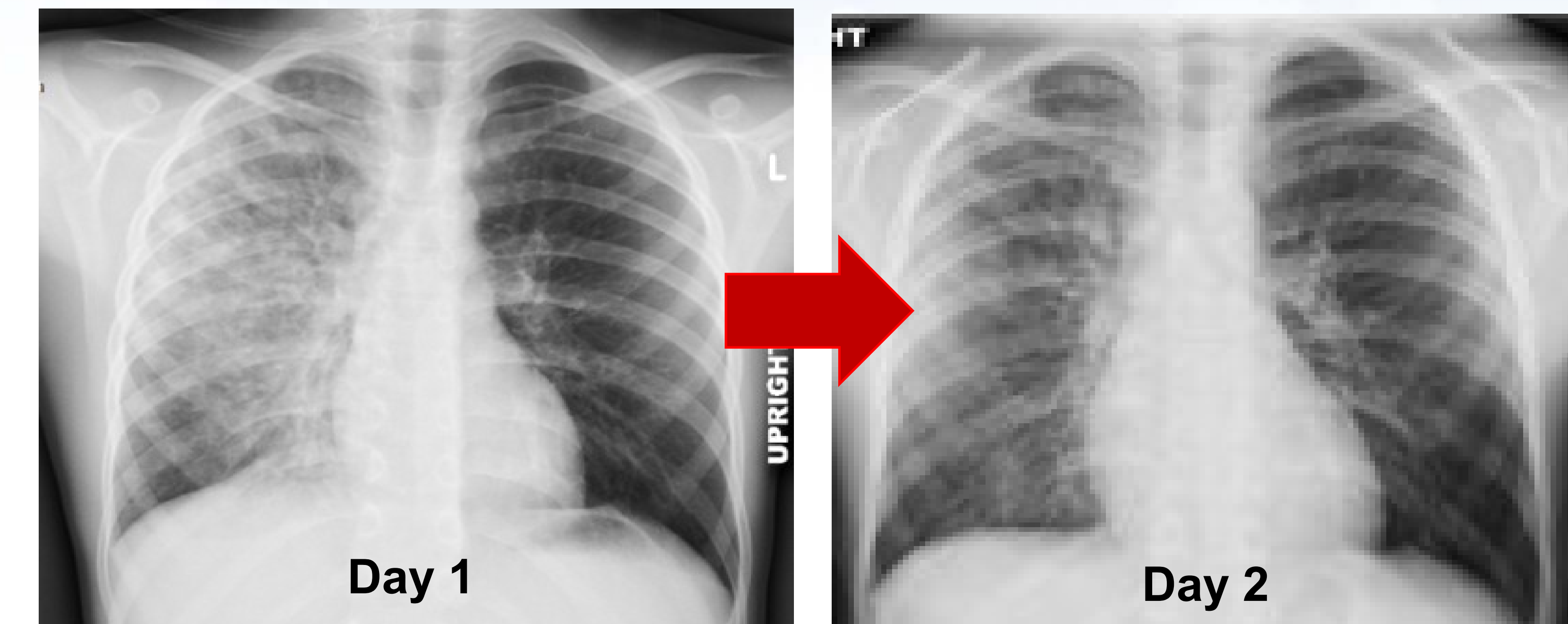
## Results

Age	Gender	Primary	Temp (C)	O2 Sat	Resident	Duration since arrival to high altitude	Prior episode
14	M	Fever, URI	37.7	85	O*	Within past 24 hours	None
5	M	Fever, cough, vomiting	37.4	86	O	4 days	None
6	F	Fever, cough, otitis media	37.2	86	O	-	None
6	M	Fever, cough, rales, otitis media	37.8	86	O	-	None
2	M	URI, wheezing, pale, otitis media	36.6	87	O	-	RSV, Flu (within 1 mo)
5	M	Fever, cough, sore throat	38.4	88	O	-	RSV, Flu
8	M	Fever, cough, sore throat, wheezing	37.1	88	O	-	None
4	M	Fever, cough	38.4	87	O	-	X1
5	M	Fever, cough, sore throat, rales	38.1	84	O	-	None
14	F	Fever, cough, sore throat	38.5	94	O	-	None
5	M	Fever, sore throat, wheezing, rales	36.7	84	O	-	X1
4	M	Fever, cough, vomiting, rales	38.5	84	O	6 days	X2
2	F	Cough, rales	37.8	85	O	-	None
5	M	Fever, cough, otitis media	38.2	88	O	-	None
6	M	Fever, cough, wheezing, abdominal pain, otitis media	38.4	85	O	-	X1
4	M	Cough, rales	37.6	86	O	24 hours	None
8	M	Cough, URI, rales	37.6	90	O	-	None
5	M	Cough, otitis media	37.8	87	O	-	None
3	F	Fever, cough	36.2	84	O	-	None
4	M	Cough, rales	39.6	72	X**	3 days	None
4	M	Fever, cough, sore throat, URI, otitis media	37.5	82	O	-	None
3	M	Cough, sore throat, URI, wheezing	37.0	84	O	-	None
5	M	Cough, URI, wheezing	37.8	87	O	-	X2
15	F	Fever, cough, wheezing	37.4	84	O	-	None
5	M	Fever, cough (Flu +), rhonchi	37.0	84	O	-	None
8	M	Fever, cough, URI	36.8	85	O	-	None
6	M	URI, wheezing	37.0	86	O	-	X2
4	F	Fever, cough, URI, wheezing	36.7	84	O	-	X1
22mo	F	Fever, cough, URI	37.1	86	O	48 hrs	None
5	M	Fever, cough	37.6	85	O	-	None
7	M	Fever, URI, rhonchi, wheezing, otitis media	38.4	86	O	-	None
10	M	Fever, cough, crackles, otitis media	36.8	86	O	-	None
7	M	Fever, cough, vomiting, abdominal pain, rales, grunting	37.2	82	O	-	None
3	F	Fever, cough, abdominal pain, crackles	37.0	85	O	-	None
16mo	F	Cough, vomiting, URI, rales	37.4	73	x	24 hrs	None
3	M	URI, rales	37.4	83	O	-	None
6	F	Fever, cough abdominal pain	37.7	82	O	-	None
6	M	Fever, cough, URI, rales, otitis media	37.8	85	O	-	None
12	F	Fever, cough	37.8	85	O	-	None
20mo	M	Fever, cough, URI, rales	36.7	86	O	-	None
12mo	F	Fever, cough, URI	37.4	82	O	24 hours	None
3	F	Cough	37.1	82	O	2 wks	None
3	M	Cough, URI	37.7	82	O	-	None
2	M	Cough	37.3	89	O	-	None

Table of HAPE patients ages 12 months to 15 years of 2015. Clinic draws from five county area above 2500 meters with populations of 5000-29000. Patients seen in 2015: 1637 with 4230 total visits.

\*O indicates that the patient is a resident of an high altitude region.

\*\*X indicates that the patient is a visitor to high altitude region.



Example: 10 year old male patient with suspected case of HAPE

## Result Summary

Diagnosis	Outcome (N=52)
Classic HAPE	2 (4%)
Reentry HAPE	7 (13%)
Resident HAPE	35 (67%)
Asthma attack	2 (4%)
Pneumonia	6 (12%)

## Conclusion

- 3 different categories of high altitude pulmonary edema can be recognized based on the etiology indicated by the patient's residency/travel history; Classic, Reentry, Resident.
- 72% of pediatric patients with clinical features consistent with HAPE were found to have Resident HAPE at our clinic (elevation 2,800m)
- Clinical diagnosis by experienced providers can avoid misdiagnosis, unnecessary antibiotics, and prevent episodes of both resident and reentry HAPE in pediatric patients.

## References

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