

## Clinical Edema and Chest X-Ray Findings in Acute Poststreptococcal Glomerulonephritis

Husein Albar, Syarifuddin Rauf, Dasril Daud, Azis Tanra, M Faried Kaspan

(Department of Child Health, Medical School, University of Hasanuddin/  
Ujung Pandang General Hospital)

**ABSTRACT** We report the results of a retrospective study evaluating clinical edema and chest X-ray findings in 176 patients with acute poststreptococcal glomerulonephritis (APSGN), hospitalized in the Pediatric Nephrology Unit of Ujung Pandang General Hospital, from January 1, 1980 through December 31, 1990. Of the total 194 patients, only 176 fulfilled the criteria and could be evaluated. There were 98 boys (55.7%) and 78 girls (44.3%) aged between 1 year 9 months and 14 years, mostly between 6-12 years (72.8%). We found that edema of the palpebra was more frequently noted (98.9%) than that of the pretibia (71.6%), face (64.2%) and ascites (21.0%). This study showed evidence of cardiomegaly (84.1%), pulmonary vascular congestion (68.2%), pleural effusion (65.9%) and pulmonary edema (48.9%). Our study results documented that roentgenographic abnormality of the chest of patients with APSGN, included each of the following findings, e.g., cardiomegaly, pleural effusion, pulmonary vascular congestion, and pulmonary edema, was significantly more frequent in patients with clinical evidence of severe edema than those with moderate and mild edema. ( $p < 0.01$ ). [*Paediatr Indones* 1997; 37:69-75]

### Introduction

Acute glomerulonephritis (AGN) is the most commonly renal disease encountered in children. The disease is caused by an immunologic mechanism and characterized by proliferation and inflammation of the glomerulus. AGN usually occurs after a recent infection with group A beta-hemolytic streptococcus, and therefore called as acute poststreptococcal glomerulonephritis (APSGN).<sup>1-4</sup>

In general, the prognosis of APSGN appears to be excellent. However, in some cases,

severe and life-threatening complications, e.g. hypertensive encephalopathy, cardiac failure, acute pulmonary edema, or renal failure may occur in the acute phase of the disease and more aggressive therapy to reduce plasma volume is sometimes indicated.<sup>4-8</sup>

Edema is the most frequent presenting symptom in APSGN.<sup>7,9</sup> Manhas *et al* found edema in 83.4% of their cases while Lewy found 66.6%.<sup>10,11</sup> Sodium and water retention not only leads to clinical edema but is also responsible for the generalized circulatory congestion. The severe circulatory congestion could be demonstrated on chest X-ray films, consisting of cardiomegaly, pleural effusion, pulmonary vascular congestion and pulmonary edema.<sup>7-10</sup> The aim of this study was to evaluate relationship between clinical edema and chest X-ray findings in patients with APSGN.

## Methods

This study was undertaken in the Pediatric Nephrology Unit of Ujung Pandang General Hospital, from January 1, 1980 through December 31, 1990, by means of collecting and evaluating the medical records of patients with APSGN. The patients, being hospitalized within the above-mentioned period and had complete medical records, were included in this study; whereas those with incomplete records were excluded.

The diagnosis of APSGN were established based on the following clinical and laboratory criteria: 1. clinical features of edema and hypertension; 2. presence of macroscopic and or microscopic hematuria with red blood cell casts in the urinary sediment; 3. recent history of group A beta-hemolytic streptococcal infection demonstrated by an elevated antistreptolysin O (ASTO) titer; and or (4) evidence of reduced serum C3 level.<sup>1,7,8,14</sup>

The degree of edema was grouped according to the site of edema as in the following:

- |                   |  |
|-------------------|--|
| 1. Mild edema     | edema is confined to the palpebra and face                                       |
| 2. Moderate edema | edema is found at the palpebra, face and pretibia                                |
| 3. Severe edema   | edema is encountered at the palpebra, face, pretibia and associated with ascites |

Chest X-ray findings, by means of exposing the patients in postero-anterior and right lateral decubitus positions, were grouped based on the following definitions:

- |                     |   |
|---------------------|---|
| 1. Cardiomegaly     | either as indicated by a cardiothoracic ratio (CTR) of more than 0.50 <sup>2,5,12,13</sup> or distinctly smaller on follow-up films. <sup>3,9</sup>   |
| 2. Pleural effusion | a diffuse and homogenous silhouette covering the costophrenic sinus or a tape-like density appearing between the chest wall and lung. <sup>3,11</sup> |

- |                         |  |
|-------------------------|--|
| 3. Pulmonary congestion | either as an increase in the size of hilar vessels or in the number of visible peripheral vessels. <sup>3,5,9</sup>  |
| 4. Pulmonary edema      | an increase area of confluent density, especially around the hilus; irregular and diffuse haziness of the lung fields; or both (pulmonary consolidation). <sup>3,5,9</sup> |

Patients who developed one or more of these chest X-ray findings were considered to have roentgenographic abnormality of the chest. Data were evaluated with X<sup>2</sup> analysis and  $p < 0.05$  was considered to be statistically significant.

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## Results

During the study period, 194 patients with APSGN were hospitalized in the Pediatric Nephrology Unit of Ujung Pandang General Hospital. Of these, 176 fulfilled the criteria and could be evaluated. These included 98 boys (55.7%) and 78 girls (44.3%). Their ages ranged from 1 year 9 months to 14 years, consisting of 38 (21.6%) being below and 138 (78.4%) above 5 years of age, mostly between 6-12 years (72.8%).

Table 1. Edema in 176 patients with APSGN

Site of edema	Number of cases	%
face	113	64.2
palpebra	174	98.9
pretibia	126	71.6
ascites	37	21.0

\* One patient may develop edema at one or more sites

Table 1 shows that edema was most frequently located on the palpebra (98.9%), followed by pretibia (71.6%), face (64.2%) and ascites (21.0%). Table 2 indicates that the most commonly demonstrated chest X-ray finding in our series was cardiomegaly (84.1%) and the least was pulmonary edema (48.9%).

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Table 2. Chest X-ray findings in 176 patients with APSGN

Chest X-ray findings	Number of patients	%
cardiomegaly	148	84.1
pulmonary congestion	120	68.2
pleural effusion	116	65.9
pulmonary edema	86	48.9

\* One patient may demonstrated chest X-ray findings of one or more kinds.

Table 3. Clinical edema and chest X-ray abnormality in 176 patients with APSGN

Degree of edema	Chest X-ray abnormality				Total	
	+	%	-	%	N	%
mild edema	50	80.7	12	19.4	62	100.0
moderate edema	69	84.6	8	16.4	77	100.0
severe edema	37	100.0	0	00.0	37	100.0
Total	156	88.6	20	11.4	176	100.0

$X^2$  (2df) = 9.2287

$p < 0.01$

Table 3 reveals that roentgenographic abnormality of the chest was more frequently found in patients with clinical evidence of severe edema than those with moderate or mild edema. The difference was significant statistically.

Table 4. Clinical edema and cardiomegaly in 176 patients with APSGN

Degree of edema	Cardiomegaly				Total	
	+	%	-	%	N	%
mild edema	46	74.2	16	25.8	62	100.0
moderate edema	66	85.7	11	14.3	77	100.0
severe edema	37	100.0	0	00.0	37	100.0
Total	148	84.1	28	15.9	176	100.0

$X^2$  (2df) = 19.5383

$p < 0.01$

Table 4 shows that cardiomegaly on X-ray was more frequently demonstrated on chest films in patients with clinical evidence of severe edema (100%) than in those with moderate (85.7%) or mild edema (74.2%). The difference was statistically significant ( $p < 0.001$ ).

Table 5. Clinical edema and pulmonary vascular congestion in 176 patients with APSGN

Degree of edema	Pulmonary congestion				Total	
	+	%	-	%	N	%
mild edema	36	58.0	26	42.0	62	100.0
moderate edema	54	70.1	23	29.9	77	100.0
severe edema	30	81.1	7	18.9	37	100.0
Total	120	68.2	56	31.8	176	100.0

$X^2$  (2df) = 9.7588                       $p < 0.05$

Pulmonary vascular congestion, which appeared on chest films, was more frequently encountered in patients with clinical evidence of severe edema (81.10%) than those with moderate (70.1%) and mild edema (58.0%). The difference was also statistically significant ( $p < 0.01$ ) as noted in Table 5.

Table 6. Clinical edema and pleural effusion in 176 patients with APSGN

Degree of edema	Pleural effusion				Total	
	+	%	-	%	N	%
mild edema	26	42.0	36	58	62	100.0
moderate edema	56	72.7	21	27.3	77	100.0
severe edema	34	91.9	3	8.1	37	100.0
Total	116	65.9	60	34.1	176	100.0

$X^2$  (2df) = 30.624                       $p < 0.001$

Table 6 indicates that pleural effusion was significantly more frequently noted in patients with clinical evidence of severe edema (91.9%) compared to those with moderate (72.7%) and mild edema (41.9%) ( $p < 0.001$ ).

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Table 7. Clinical and pulmonary edema in 176 patients with APSGN

Degree of edema	Pulmonary edema				Total	
	+	%	-	%	N	%
Mild edema	17	27.4	45	72.6	62	100.0
Moderate edema	44	57.2	33	42.8	77	100.0
Severe edema	25	67.6	12	32.4	37	100.0
Total	86	48.9	90	51.1	176	100.0

$X^2$  (2df) = 20,383

$p < 0.001$

Table 7 shows that pulmonary edema, demonstrated on chest films, was significantly more frequent in patients with clinical evidence of severe edema (67.6%) compared to those with moderate (57.2%) and mild edema (27.4%) ( $p < 0.001$ ).

## Discussion

In general, the literature reported that palpebral edema was the most common presenting clinical edema in patients with APSGN.<sup>1,8,10,14</sup> In the present study, we noted that palpebral edema was also mostly found in our cases (Table 1).

Kirkpatrick et al documented the chest X-ray findings in their series as follows: pulmonary congestion 74%, cardiomegaly 62%, pleural effusion 55% and pulmonary edema 33%.<sup>9</sup> Whereas, our study demonstrated cardiomegaly 84.10%, pulmonary congestion 68.2%, pleural effusion 65.90% and pulmonary edema 48.3%, respectively (Table 2).

According to the results of this study, we found that roentgenographic abnormality of the chest of patients with APSGN was significantly more frequent in patients with clinical evidence of severe edema (90%) than those with moderate (72.70%) and mild edema (41.9%) (Table 3,  $p < 0.01$ ). The same was also true for the following individual chest X-ray findings, e.g.: cardiomegaly, pulmonary congestion pleural effusion, as well as pulmonary edema (Tables 4 through 7;  $p < 0.01$ ).

There are multifactorial causes leading to clinical edema and circulatory congestion. One of them is considered to be sodium and water retention.<sup>6,8,9,14</sup> The circulatory congestion secondary to an increase in plasma and extracellular fluid (ECF) volume may be responsible for the chest X-ray abnormalities. However, there may be occasionally an increase in ECF without clinical evidence of edema.<sup>14</sup> Fourteen percent of Kirkpatrick's cases with mild clinical course revealed normal chest X-ray findings.<sup>9</sup>

According to the results of this study, we concluded that: (1) Edema of the palpebra was the most common presenting clinical edema in patients with APSGN; (2) Cardio-

megaly was the most frequent chest X-ray feature found in patient with APSGN; (3) Roentgenographic abnormality of the chest of patients with APSGN, included each of the following findings, e.g., cardiomegaly, pleural effusion, pulmonary vascular congestion, and pulmonary edema, was more frequent in cases with clinical evidence of severe edema than those with moderate and mild edema.

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