

Evaluation of the Appearance of Cardiomegaly on Chest Films of Pediatric Patients with Acute Poststreptococcal Glomerulonephritis

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ABSTRACT We evaluated 17 patients with acute poststreptococcal glomerulonephritis (APSGN) hospitalized in the nephrology ward of Wahidin Sudirohusodo Hospital Ujung Pandang. The initial chest films and echocardiograms demonstrated the presence of cardiomegaly and pericardial effusion, respectively. Seven days later, either the cardiomegaly or the pericardial effusion disappeared. According to the statistical analysis, the relationship between the occurrence of cardiomegaly and pericardial effusion was significant ($p < 0.001$). From this study we conclude that the occurrence of cardiomegaly in patients with APSGN seems to be due to pericardial effusion. Our findings need to be confirmed by studying a larger number of patients. [*Paediatr Indones* 1999; 39:172-176]

Introduction

Acute glomerulonephritis is a renal disease, in which the proliferation and inflammation of the glomerulus are secondary to an immune mechanism. The most common form of acute glomerulonephritis in children is acute poststreptococcal glomerulonephritis (APSGN).^{1,2} Roentgenographic abnormalities of the chest of patients with APSGN have been previously reported, ranging from 62.5% to 85.5%. These abnormalities include cardiomegaly, pulmonary vascular congestion, pleural effusion, and pulmonary edema.^{3,4} Plasma volume is usually increased, presumably as the result of the retention of sodium and water by the kidney. This hypervolemic state accounts for the

characteristic clinical and radiographic signs of generalized circulatory congestion during the phase of edema.^{1,5,6,7}

The diagnosis of a typical case of APSGN is straightforward, however, some atypical cases may be misdiagnosed as pneumonia, congestive heart failure, or encephalopathy resulting in serious errors of management. Therefore, a comprehensive approach to establish the diagnosis of APSGN is very crucial.⁸ The aim of this study is to evaluate the appearance of cardiomegaly on chest films of patients with APSGN.

Methods

All patients with APSGN hospitalized at the Pediatric Nephrology ward of Ujung Pandang General Hospital from January 1, 1989 to December 1993 were entered into this study. The diagnosis of APSGN was established based on the following criteria:^{7,9} 1) edema, 2) hypertension, 3) hematuria with red blood cell casts, 4) historic and or serologic evidence of streptococcal infection (a rise in ASO titer), 5) decreased serum C3 level, and 6) spontaneous improvement within a few days or weeks.

Chest X-ray examinations on the posteroanterior and right lateral decubitus positions were performed on admission and the follow-up chest X-ray examinations on the same positions were made seven days later. Cardiomegaly, as seen on chest films, is defined as a cardiothoracic ratio (CTR) of more than 0.50 (10) and or cardiac silhouette became distinctly smaller on the follow-up films.⁴ M-mode echocardiography was done on admission and repeated seven days later, simultaneously with the chest X-ray examinations. A normal M-mode echocardiogram is defined as a normal left and right ventricular dimension and ventricular wall motion. Pericardial effusion is indicated by the evidence of an echo-free space between the posterior left ventricular wall and the pericardium during the antire cardiac cycle.¹¹

Patients with complete medical records, chest films, and echocardiogram were subsequently evaluated. The X² with Yates correction and students test were used for statistical analysis and the significance level was set at $p < 0.05$.

Results

Out of 106 patients with APSGN being enrolled in this study, only 17 were further evaluated, comprising of 11 boys (65%) and 6 girls (35%). The patients' age varied from 2 years and 2 months to 12 years, the majority was older than 5 years (77%). Boys predominated with a ratio of about 1.8:1. The age and sex distribution of the patients is shown in Table 1.

Table 1. Distribution of patients according to age and sex

Age (years)	Boy	Girls	Total
0-5	3	1	4
5-10	3	2	5
>10	5	3	8
Total	11	6	17

Table 2 shows that the mean CTR value of the follow-up chest films become smaller (0.47) than those of the initial (0.55) and the difference is statistically significant ($p < 0.001$).

Table 2. Comparison of the CTR at initial and on follow-up chest films

CTR	n	Range	Mean (SD)
Initial	17	0.48-0.62	0.55 (0.02)
Follow-up	17	0.44-0.59	0.47 (0.04)

$t = 12.74$ $p < 0.0001$

It appears that the pericardial effusion was absent on the follow-up echocardiograms in all cases (Table 3).

Table 3. The presence of pericardial effusion at initial and on follow-up echocardiograms

Pericardial effusion	Positive	Negative	Total
Initial	17	0	17
Follow-up	0	17	17

Table 4 shows that there is a significant relationship between the occurrence of cardiomegaly and pericardial effusion. In other words, if cardiomegaly is seen on the chest films of patients with APSGN, echocardiograms will also demonstrate the presence of pericardial effusion.

Table 4. Distribution of pericardial effusion in patients with 'cardiomegaly'

Pericardial effusion	Yes	No	Total
'Cardiomegaly'	17	0	17
No 'cardiomegaly'	0	0	0
Total	17	0	17

$\chi^2 = 16.00$; $p < 0.001$

Discussion

Patients with APSGN generally demonstrate roentgenographic abnormalities on their chest films, including cardiomegaly, pleural effusion, pulmonary congestion and pulmonary edema.^{4,9,12} Cardiomegaly appears to be best assessed by determining CTR on chest films. In normal children, CTR should not exceed 0.50, except in neonates and young children. Enlargement of the cardiovascular shadow meaning cardiomegaly on chest films may be due to generalized dilatation of the heart, enlargement of one or more chambers, or pericardial effusion. It seems that m-mode and two-dimensional echocardiography are the best tools available for rapid and reliable identification of pericardial effusion and myocardial disease.^{10,11} The cardiomegaly seen on the chest films of our patients was detected by the CTR results and the pericardial effusion was identified by the M-mode echocardiogram patterns.

The result of this evaluation reveals that all of the seventeen patients showed cardiomegaly on their initial chest films and pericardial effusion with normal intracardiac structures on their echocardiogram, as well. About seven days later either the follow-up chest films or the echocardiogram showed no evidence of cardiomegaly and pericardial effusion, respectively (Tables 2 and 3). Statistical analysis showed that there was a significant relationship between the occurrence of cardiomegaly and that of pericardial effusion (Table 4).

It is stated that accumulation of less than 150 ml fluid in the pericardial sac not be detected clinically or radiographically.¹³ All of our cases have shown cardiomegaly on their initial chest films. It means that the amount of fluid accumulating in their pericardial sacs may be more than 150 ml. This amount of fluid can be easily detected by the echocardiography examination.

It seems that the cardiovascular disturbances occur in most patients with APSGN in early phase of the illness and the clinical picture sometimes closely resemble that of

congestive heart failure. However, there is no proof of myocardial damage in the majority of patients with APSGN and the cardiac manifestations usually subside rapidly with the onset of diuresis.^{1,12} In general, many patients with APSGN exhibit signs of circulatory congestion in the form of cardiac enlargement, pulmonary edema, pleural effusion and increased pulmonary vascular markings on X-ray examination but show no clinical symptoms and signs of cardiac failure. Measurements of the circulatory dynamics in these patients rule out the presence of cardiac failure, and the term: "non-cardiac circulatory congestion" therefore has been coined to describe this hypervolemic state.^{5,7} From this study we conclude that the occurrence of cardiomegaly in pediatric patients with APSGN seems to be due to the presence of pericardial effusion. Our findings need to be confirmed by studying a larger number of patients.

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