CASE REPORT

Prednisone induced two-way myocardial development in a patient with systemic lupus erythematosus

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SUMMARY

We present a series of echocardiography images to demonstrate the myocardial response to a high dose of prednisone. A young woman with systemic lupus erythematosus (SLE) associated with interventricular septal hypertrophy exhibited a high pressure gradient between the ascending aorta and left ventricular outflow tract as well as significant systolic anterior motion (SAM) and mitral regurgitation (MR) during high-dose prednisone treatment. However, the pressure gradient decreased dramatically and the MR disappeared rapidly when the dose of prednisone was reduced. To the best of our knowledge, this is the only adult case of myocardial hypertrophy that is assumed to be related to prednisone use.

BACKGROUND

Prednisone, one of the glucocorticoids, is often used to treat patients with systemic lupus erythematosus (SLE). However, the severe and rapid side effects of prednisone in the myocardium are rarely reported.

CASE PRESENTATION

A 28-year-old woman with Sjögren's syndrome was re-diagnosed with SLE after a 4-year irregular course of prednisone (approximately 10–20 mg/day). She did not report cardiac discomfort, and her echocardiogram was normal in 2009. The patient began to experience chest distress associated with panting beginning in October 2011. A two-dimensional echocardiogram revealed anterior and posterior basal septal thickening in December 2011 (12.1 mm compared with 9 mm in 2009, figure 1A). The velocity at the left ventricular outlet was 234 cm/s (compared with 195 cm/s in 2009, figure 1B). The patient suffered from cough and high fever without runny nose or sore eyes on 15 January 2012. Her white cell count was 14×10^9/L, and bacterial infection was considered. After administration of cefotaxime by intravenous injection for 3 days, her fever subsided. However, she subsequently presented with rash and erythema. The patient was then diagnosed with active SLE according to the markedly increased levels of anti-dsDNA and anti-nuclear antibody. After the dose of prednisone was increased from 20 to 120 mg/day for 3 days, it was reduced to 40 mg/day for 8 days and subsequently increased to 120 mg/day for 3 days until 30 January. At this point, the rash and erythema were under control; however, the panting was exacerbated. A physical examination revealed a grade 4/6 systolic murmur over the precordial area and left sternal border and a grade 3/6 systolic murmur at the apex. Repeat echocardiography showed dramatic changes, including an increase in the thickness of the anterior septum at base level to 12.7 mm (figure 1C), a sharp increase in the velocity at the left ventricular outlet to 703 cm/s (pressure gradient, 198 mm Hg; figure 1D) that was associated with significant systolic anterior motion (SAM) (figure 1E), and severe mitral regurgitation (MR) (figure 1F). Moreover, a significant mitral prolapse was also found, which appeared to be vegetation on transoesophageal echocardiography (figure 1G).

DIFFERENTIAL DIAGNOSIS

There are several possible factors other than steroid therapy that may have induced septal thickness:

(1) Viral infection-induced myocarditis. The shortness of breath and fever observed from December 2011 to January 2012 were less likely to be due to viral infection because typical symptoms of viral infection, such as runny nose, muscular soreness and eye redness, were not present. Usually, viral infection is not accompanied by high white cell counts. Because the silent increase in the wall thickness occurred much earlier than 2011, acute viral infection-induced myocarditis was not considered.

(2) Hypertension-induced myocardial hypertrophy. The patient was a 28-year-old woman with no history of hypertension. She did present with hypertension (145/90 mm Hg) during the high-dose prednisone treatment; however, the degree and duration of hypertension were also highly unlikely to contribute to the rapid progression of hypertrophy.

TREATMENT

The dose of prednisone was decreased to 40 mg/day and gradually decreased to 15 mg/day over the next month.

OUTCOME AND FOLLOW-UP

Interestingly, a repeat echocardiography performed on 21 February 2012 showed that the thickness of the posterior septum increased to 18.2 mm and that of the lateral wall at the papillary muscle level increased to 13.9 mm (figure 1H), while the velocity at the left ventricular outlet decreased to 172 cm/s (pressure gradient, 12 mm Hg; figure 1I),

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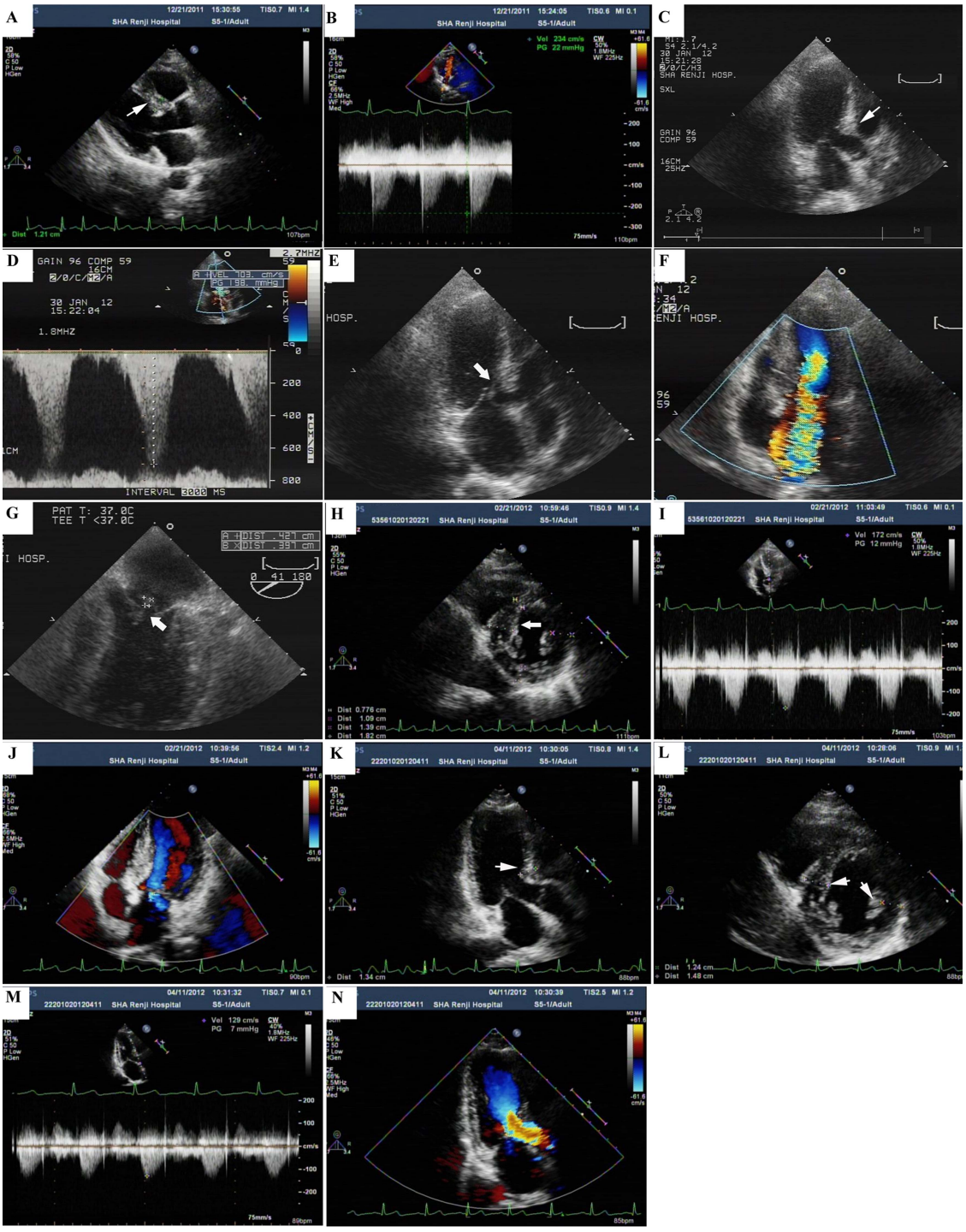

Figure 1 Echocardiographic findings of the patient with systemic lupus erythematosus during the course of prednisone treatment. (A and B) An apical four-chamber view showed a thickening of the anterior septum at the base level (white arrow) before the flushing dose of prednisone. Continuous-wave Doppler showed that the velocity in the left ventricular outlet was 234 cm/s (22 mm Hg). (C–G) The thickness of the anterior septum increased to 12.7 mm in the apical three-chamber view, and the velocity in the left ventricular outlet increased to 703 cm/s (198 mm Hg). There was a significant systolic anterior motion (white arrow) in the apical three-chamber view. Severe mitral regurgitations and excrescence-like mitral prolapse (arrow) were detected after the dose of prednisone was increased to 120 mg/day for 3 days. (H–J) After the dose of prednisone decreased to 15 mg/day, the thickness of the posterior septum increased to 18 mm, but the velocity in the left ventricular outlet decreased to 172 cm/s. The systolic anterior motion and mitral prolapse disappeared; only mild mitral regurgitation was observed (J). (K–N) After 50 days of follow-up, the thickness of the septum decreased gradually under the maintained prednisone dose. Only mild mitral regurgitation was observed. The velocity in the left ventricular outlet remained normal.

SAM and mitral prolapse disappeared, and only mild MR was detected (figure 1J). At a 50-day follow-up, the thickness of the septum gradually decreased under the 15 mg/day prednisone dose (figure 1K, L), the velocity in the left ventricular outlet was maintained at a normal level (figure 1M), and only mild MR was observed (figure 1N).

Table 1 Clinical and echocardiographic findings during the therapeutic course

Date	22 September 2009	21 December 2011	15 January 2012	18 January 2012	30 January 2012	21 February 2012	11 April 2012
Symptoms	No	Short breathing	Cough, fever	Erythema, rash without fever	Chest tightness, shortness of breath	Palpitations	Slight chest tightness
Dosage of prednisone	10–20 mg/day and irregular use	10–20 mg/day	20 mg/day	120 mg/day for 3 days, 40 mg/day for 8 days, 120 mg/day for 3 days	40 mg/day and reduce gradually	15 mg/day	15 mg/day
Antibiotic medicine	No	No	Cefotaxime for 3 days	No	No	No	No
Septal thickness (mm)	9	12 at base	NA	NA	12–13 at base	18 at postseptal level	13 at base and 12–15 at postseptal level
Flow velocity in subaortic valves (cm/s)	195	234	NA	NA	703	172	129
Pressure gradient in subaortic valves (mm Hg)	15	22	NA	NA	198	12	7
SAM	No	No	NA	NA	Yes	No	No
Mitral valve	Normal	Normal	NA	NA	Severe MR with mitral prolapse	Without mitral prolapse, mild MR	Without mitral prolapse, mild MR

MR, mitral regurgitation; NA, not applicable; SAM, systolic anterior motion.

Table 1 lists the symptom, medication and change in echocardiographic parameters from 2009 to 21 February 2012. The same sonographer performed the echocardiograms during the course of the disease.

The characteristics of this case are as follows: (1) a sharp increase and decrease in the pressure gradient at the left ventricular outlet accompanied by a rapid appearance and disappearance of mitral prolapse and regurgitation; (2) rapid thickening of the interventricular septum and (3) newly emerged heart murmurs. These characteristics were all related to changes in prednisone use.

DISCUSSION

Prednisone is often recommended for the treatment of patients with SLE. The dosage is added in the situation of SLE activation. Progressive myocardial hypertrophy is an unwanted side effect that occurs during the flushing dose of prednisone. A high dose of prednisone (60 mg/day) can boost the left ventricular ejection fraction (4.3±1.5 percentage points compared with control (P=0.05)) and will most likely introduce subaortic valve obstruction. In this case, the newly emerged murmur over the precordial area accounted for the sharply increased velocity at the left ventricular outlet. Additionally, SAM caused by the Venturi effect and the murmur at the apex accounted for the aggravated MR. When the dose of prednisone was decreased from 120 to 15 mg/day, SAM, the obstruction at the left ventricular outlet, mitral prolapse and MR were significantly ameliorated. After more than 1 month of follow-up, posterior septal and lateral wall hypertrophy tended to revert to normal. The corresponding murmurs over the precordial area and apex also disappeared.

The myocardial hypertrophy in this case appeared to be ameliorated during follow-up. Previous reports showed that the side effects of prednisone on the myocardium were mainly related to dilated cardiomyopathy[1] or heart failure. Boeuf *et al*[2] reported four cases of dexamethasone-induced and/or betamethasone-induced myocardial hypertrophy in premature infants who were given the drugs to prevent bronchopulmonary dysplasia. The first echocardiographic changes in the infant cases appeared between the 4th and the 15th day of the glucocorticoid course, while in our study the changes appeared on the 14th day. The cumulative dose in the infant cases was 1.8–3.9 mg/kg, whereas 17.3 mg/kg was used in our case. The pressure gradient resolved completely from 2 to 4 weeks after decreasing the dose of prednisone in the study of Boeuf *et al*; in our study, resolution was achieved in 3 weeks. Myocardial hypertrophy resolved completely between 2 and 4 weeks after cessation of the treatment in the study of Boeuf *et al*; in our study, further progress was halted, which may be due to the higher dose of prednisone in our patient.

Learning points

- Marked myocardial hypertrophy is unusual but can be discovered after a high dose of prednisone.
- The mechanism underlying prednisone-induced myocardium hypertrophy is unknown.
- We suggest that when the prednisone dose is higher than 60 mg/day or the cumulative dose is higher than 15 mg/kg, careful monitoring is required to detect cardiac abnormalities within 1 month.

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Competing interests None.

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