

Spinal deformity caused by hyperimmunoglobulin E syndrome

Case report

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Hyperimmunoglobulin E syndrome (HIES) is a rare primary immunodeficiency syndrome characterized by recurrent staphylococcal infections in the skin and lungs, with an incidence of less than one case per million persons. Skeletal and connective tissue abnormalities, such as scoliosis, osteoporosis, pathological fractures, and hyperextensive joints, are other manifestations of HIES. However, only one report documents the use of implants to treat spinal deformity caused by HIES, which was discovered following corrective surgery resulting in postoperative infection. In this case report, the authors describe a 16-year-old male with low-back pain and infections of the soft tissue. Radiological findings showed deteriorated kyphotic deformity due to the pathological compression fracture of T-11 with intensive conservative treatment. Anterior and posterior fixation surgery was performed. Thereafter, the patient showed no signs of infection. An investigation was conducted to avoid any postoperative infection.
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KEY WORDS • **Hyper IgE syndrome** • **Job's syndrome** • **osteoporosis** •
spinal deformity • **immunodeficiency** • **infection**

HYPERIMMUNOGLOBULIN E syndrome (HIES) was first reported as Job's syndrome in 1966 by Davis;¹ it was characterized by elevated serum levels of IgE, chronic eczemas, and recurrent respiratory and soft tissue infections.¹¹ Recently, the cause of HIES was identified as a genetic mutation of *STAT3* and *TYK2*.¹¹ Symptoms can include not only immune system abnormalities, but also skeletal and connective tissue abnormalities, such as scoliosis, osteoporosis, pathological fractures, and hyperextensive joints.¹¹ To date, however, only one report has documented scoliosis caused by HIES, which was discovered following corrective surgery that had resulted in postoperative infection.¹³ To our knowledge, the present report is the first on the surgical treatment of spinal deformity caused by HIES, which was diagnosed presurgery. Here we describe the case of a surgically treated spinal deformity caused by HIES and discuss various perioperative prophylaxes for preventing postoperative infections in patients with HIES.

Abbreviations used in this paper: BMD = bone mineral density; HIES = hyperimmunoglobulin E syndrome.

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Case Report

History and Examination. A 16-year-old male reported back pain with no evidence of trauma. He visited a nearby hospital, but an examination did not show anything out of the ordinary at that time. Two months later, his back pain continued to worsen. He underwent plain radiography and MRI, and a T-11 compression fracture was diagnosed (Fig. 1). He was then hospitalized at the previous institution for further examination and treated with absolute bed rest. A PET-CT there revealed pathological FDG uptake in the lung, upper jaw, left hip, and T-11 vertebral body (Fig. 2). Because tumor metastasis was suspected, a biopsy of the left hip mass was performed and revealed an infection of *Staphylococcus aureus*. Hyperimmunoglobulin E syndrome was diagnosed because of the elevated serum levels of IgE (Table 1), soft tissue infection, and lung abscess.

The patient was transferred to our hospital where we applied a hard brace to immobilize the fracture. His

This article contains some figures that are displayed in color online but in black-and-white in the print edition.

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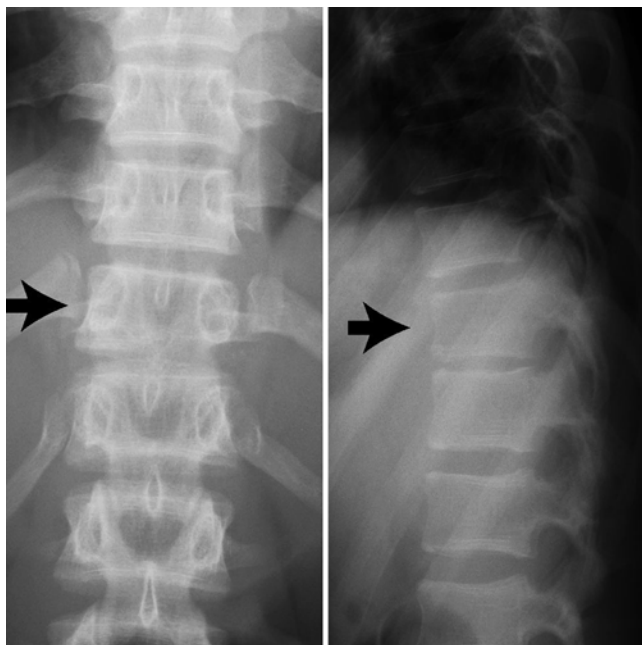


FIG. 1. Plain radiographs showing a compression fracture of T-11 (arrows).

medical history revealed that he had experienced a recurrent surgical site infection when he underwent an Ilizarov surgery for Blount's disease. Genetic investigation to confirm the diagnosis revealed a mutation in *STAT3*. During the radiographic examination, it was discovered that the spinal deformity caused by the compression fracture had rapidly become worse, with a local Cobb angle (T10–12) of 50° (Fig. 3). To avoid the possibility of infection, we performed a spine biopsy as a safety measure. Pathologically, the specimen did not show signs of active inflammation. Additionally, the culture was negative. Thus, we concluded that the compression fracture was caused by bone fragility from the HIES, not by the infection. Even after intensive conservative treatment, his low-back pain continued and

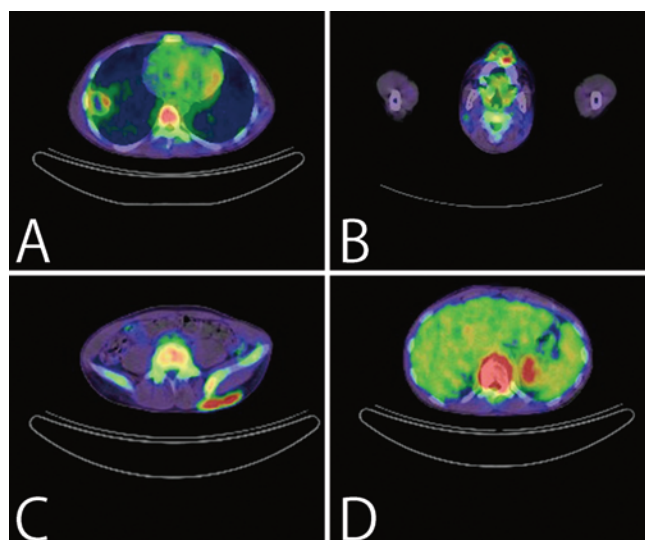


FIG. 2. PET-CT scans showing pathological FDG uptake in the lung (A), upper jaw (B), left hip (C), and T-11 vertebral body (D).

TABLE 1: Preoperative laboratory data*

Variable	Our Patient	Reference Range
WBC (cells/ml)	9400	3600–9300
hemoglobin (g/dl)	9.0	13.8–16.9
CRP (mg/dl)	9.57	<0.3
IgG (mg/dl)	2168	868–1780
IgA (mg/dl)	378	122–412
IgM (mg/dl)	292	28–177
IgE (IU/ml)	3188	<173
bone alkaline phosphatase (μg/L)	15.3	3.7–20.9
deoxypyridinoline (nmol/mmol × creatinine)	15.9	2.1–5.4
BMD (% of young adult mean)	88	

* CRP = C-reactive protein; WBC = white blood cell.

the kyphosis became worse. The pain and deformity made him a suitable candidate for reconstructive surgery. Therefore, we asked the patient and his family if he was willing to treat the kyphosis with surgery, since he had an immune deficiency. They consented, even though they realized the high risk of postoperative infection.

Operation. We performed an anterior and posterior reconstruction and fusion surgery. At first, the lesion was approached through a standard posterolateral thoracotomy over the superior edge of the ninth rib. We performed two discectomies (T10–11, T11–12), a partial corpectomy of T-11, and positioning of a left fibula and rib graft. Then, after moving the patient into the prone position, we proceeded to perform the T9–L1 posterior fusion using pedicle screws. As a result, the postoperative kyphosis Cobb angle was improved to 10° (Fig. 4).



FIG. 3. Plain radiographs showing deteriorated local kyphosis (Cobb angle 50°).

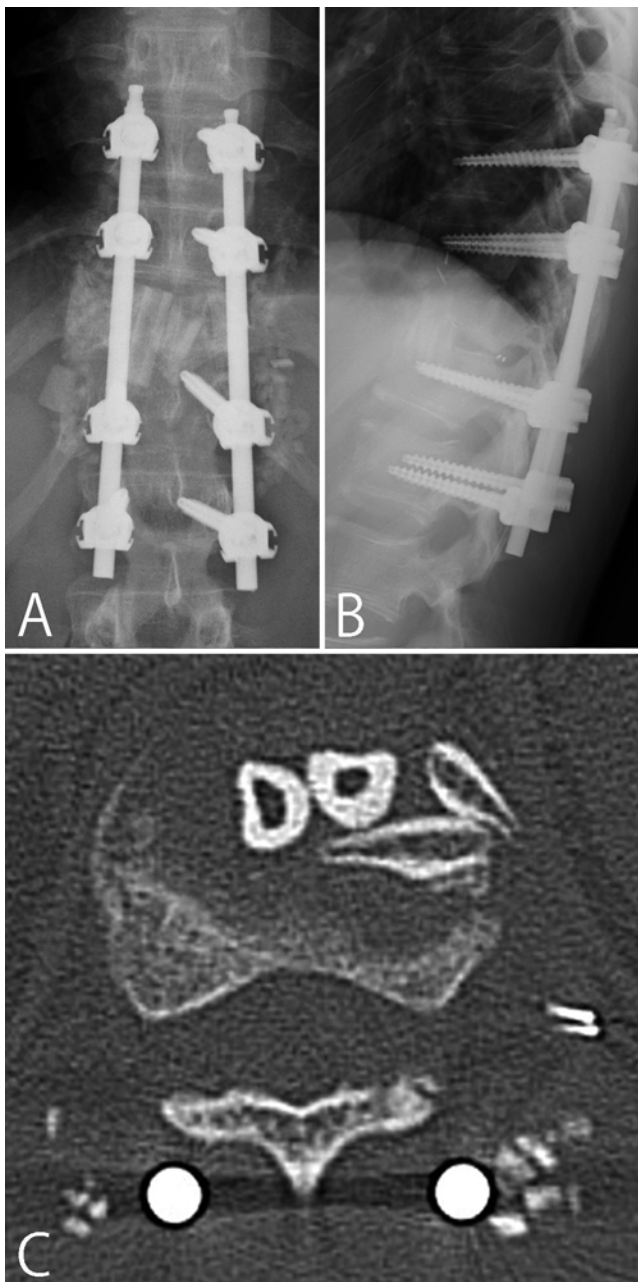


FIG. 4. Postoperative plain radiographs (**A and B**) showing improved local kyphosis (Cobb angle 10°). Axial CT image (**C**) showing the position of the rib and fibula graft positioned in the patient.

To reduce the risk of infection, 4 days prior to surgery we prepared the patient by administering intravenous Ig. On the day of surgery, we administered vancomycin at 8-hour intervals. We also gave him itraconazole orally as a precautionary measure against fungal infection. For treatment of the lung abscess, we continued the administration of trimethoprim/sulfamethoxazole and ampicillin/sulbactam. The latter combination was switched to cefaclor given the improvement of his lung abscess 10 days postoperation.

Postoperative Course. He was discharged 3 weeks after the surgery without any signs of infection and back

TABLE 2: Postoperative laboratory data*

Parameter	Postop Month					Reference Range
	1	3	6	12	15	
CRP (mg/dl)	<0.03	0.54	<0.03	0.02	0.03	<0.3
ESR (mm/hr)	5	8	2	0	3	<15

* CRP = C-reactive protein; ESR = erythrocyte sedimentation rate.

pain. At his most recent follow-up 15 months after surgery, he showed no signs of surgical site infection, which was confirmed by stable, normal C-reactive protein levels and erythrocyte sedimentation rate levels (Table 2). While the patient's back pain was resolved, a slight loss of reduction in kyphosis Cobb angle was observed on plain radiographs (Fig. 5).

Discussion

Hyperimmunoglobulin E syndrome is a rare primary immunodeficiency disorder that can also be characterized by skeletal abnormalities, with an incidence of less than 1 case per million persons.⁵ Recurrent pathological fractures are noted in more than 50% of patients with HIES.⁵ Typically, long bones are affected,⁸ and the vertebral column can also be involved.⁴ Interestingly, bone mineral density (BMD) is not always a good predictive factor for these pathological fractures. Indeed, the patient in our case appeared to have high bone resorption activity given the elevated urine levels of deoxypyridinoline, but his BMD was within the normal range (Table 1). Hyperimmunoglobulin E syndrome can also cause scoliosis, although the precise mechanisms are yet to be identified.¹¹

The surgical indication for juvenile kyphosis has not yet been well established. Opinions are divided regarding

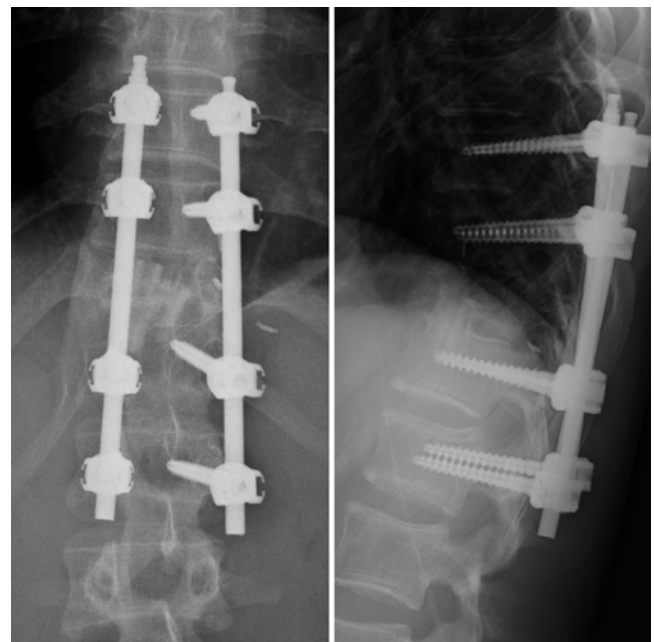


FIG. 5. Postoperative (15 months) plain radiographs showing a slight loss of reduction in local kyphosis.

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the application of surgical and nonsurgical procedures in the treatment of juvenile kyphosis.^{6,10} As a result, a decision for surgical intervention is an individual one between surgeons and their patients.¹⁴ Recently, increasing sagittal plane deformity has been reported to have a significant impact on health-related quality of life, especially in pain and self image.^{9,12} In our case, continuous pain and deteriorating severe local kyphosis led us to consider performing reconstructive surgery.

Indeed, there is much to consider in terms of preventing postoperative infection in patients with HIES.¹³ After reviewing the featured case and considering the patient's current status and medical history along with other cases of HIES, we applied preventive measures in the form of antibiotic administration. Because of his lung abscess, the patient was given ampicillin/sulbactam, trimethoprim/sulfamethoxazole, and cefaclor. Additionally, vancomycin was administered right before and the day after surgery to prevent the occurrence of infections of methicillin-resistant *Staphylococcus aureus*, given the patient's long use of various antibiotics.

We also administered intravenous Ig as an immunoprophylaxis, since some reports have documented the usefulness of intravenous Ig for the control of infection with HIES.^{2,3,7}

Conclusions

In summary, the success of the patient's spinal surgery was largely attributable to actions we took to avoid infections through the use of various appropriate antibiotics and the administration of intravenous Ig. We must consider the possibility of HIES in juvenile spinal deformity cases, taking into account that these patients have an immune deficiency.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Inose. Acquisition of data: Inose. Analysis and interpretation of data: Inose. Drafting the article: Inose, Araya. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Inose.

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