

# Subcutaneous Fat Necrosis of the Newborn Associated with Cardiomyopathy

Tae Yoon Kim<sup>2</sup>, M.D., Dou Hee Yoon, M.D., Tae Yoon Kim<sup>1</sup>, M.D.,  
Chung Won Kim, M.D., Jee Hyun Chang\*, M.D., Jung Sik Chun\*, M.D.

*Department of Dermatology and Pediatrics\*, Kangnam St. Mary's Hospital,  
The Catholic University of Korea, Seoul, Korea*

Subcutaneous fat necrosis of the newborn is an uncommon disorder characterized by firm subcutaneous plaques and nodules usually appearing shortly after birth. It runs a relatively benign course and may completely resolve in a few months without any recurrence.

We report a case of subcutaneous fat necrosis in a 15 day-old male suffering from severe perinatal asphyxia and hypoxic cardiomyopathy, who presented with indurated subcutaneous nodules and plaques on the both shoulders and the back. Histologically the subcutaneous fat showed focal necrosis with needle-shaped clefts, lymphohistiocytic infiltration and foreign body reactions consistent with subcutaneous fat necrosis of the newborn.

In our patient, compromised cardiac output due to cardiomyopathy might have aggravated the hypoxic condition and it could be speculated that cardiomyopathy-induced systemic hypoxia gave rise to hypothermia of the skin as a result of peripheral vasoconstriction.

This report presents a causal relationship of cardiomyopathy and subcutaneous fat necrosis of the newborn. (*Ann Dermatol* 9:(1)36~40, 1997).

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*Key words* : Cardiomyopathy, Subcutaneous fat necrosis of the newborn

Subcutaneous fat necrosis of the newborn is an uncommon disorder characterized by firm subcutaneous plaques and nodules usually appearing shortly after birth<sup>1</sup>. Lesions are found primarily on the cheeks, shoulders, trunk, buttocks, arms, and legs. There is often a history of difficult or prolonged labor, preeclampsia, or fetal distress sometimes necessitating caesarean section<sup>2</sup>. Although the cause is not well known, difficulties at birth can be identified in many affected infants and include cyanosis, apnea, seizures, forceps manipulation, meconium aspiration and hypothermia<sup>1,2</sup>.

It runs a relatively benign course and may completely resolve in a few months without any recurrence<sup>2</sup>. Death may rarely occur in the setting of

sepsis, profound cachexia or hypercalcemia. Symptomatic hypercalcemia, which may not become apparent until 1 to 3 months after birth, has been associated with subcutaneous fat necrosis of the newborn. Symptoms include failure to thrive, vomiting, irritability and seizures<sup>2</sup>. Birth trauma was reported to be mostly associated with subcutaneous fat necrosis of the newborn in Korean literature<sup>3,9</sup>. However, a case with a definite organic disease such as cardiomyopathy has not been reported.

We present a case of subcutaneous fat necrosis of the newborn associated with cardiomyopathy which might be one of the possible etiological factors.

## Case

A 1-day-old male infant was admitted to the department of pediatrics at Kangnam St. Mary's hospital for cyanosis. The infant had been delivered by an emergency caesarean section for fetal dis-

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Reprint request to : Tae Yoon Kim<sup>1</sup>, M.D., Department of Dermatology Kangnam St. Mary's Hospital, The Catholic University of Korea, Seoul, Korea

**Table 1.** Summary of the cases of the subcutaneous fat necrosis of the newborn reported in Korean literatures.

Case No.	Authors	Age/Sex	Onset of age	Involution	Site	Delivery	Asphyxia	Serum Ca level	Associated disease
1	Kim, et al <sup>3</sup> (1974)	1 month/F	3 weeks	6 weeks	deltoid area, back, buttock	NSD	no	not done	none
2	Cha, et al <sup>4</sup> (1983)	1 month/M	3 days	4 months	shoulder, back, buttock	C/S CPD	yes	normal	none
3	Sim, et al <sup>5</sup> (1984)	13 days/M	9 days	2 months	axilla, neck	NSD dystocia	yes	not done	none
4	Park, et al <sup>6</sup> (1986)	1 month/M	2 days	2 months	right arm, right cheek	unknown	unknown	normal	none
5	Chun, et al <sup>7</sup> (1986)	12 days/M	12 days	30 days	buttock, right arm	C/S CPD	yes	decreased	encephalopathy
6	Suh, et al <sup>8</sup> (1990)	1 month/M	10 days	6 weeks	right arm, scalp, back, buttock	NSD dystocia	yes	elevated	hypoxic-ischemic encephalopathy
7	Jeon, et al <sup>9</sup> (1994)	7 days/F	7 days	4 weeks	back	C/S CPD	yes	normal	none
8	Present Case	1 month/M	15 days	2 months	shoulder, back	C/S CPD	yes	elevated and then decreased	cardiomyopathy

CPD: cranio-pelvic disproportion

C/S: Caesarean section

NSD: normal spontaneous delivery

ness in the local clinic. The birth weight was 4,620 grams and the Apgar score was 4 at the first minute and 5 after 5 minutes after delivery. One hour after delivery, the infant had an apneic episode and peripheral cyanosis. Asphyxia was confirmed by metabolic acidosis with a venous blood pH of 7.14. A chest radiograph showed moderate cardiomegaly (Fig. 1), and echocardiographic findings also represented cardiomyopathy and tricuspid regurgitation. The infant was nursed in an incubator and correction of the hypoxia was achieved with 90% inspired oxygen via artificial breathing. After the acidosis had been treated with sodium bicarbonate, the acid base status improved (pH 7.47, base excess 1 mmol/L).

On the 15th day of life, erythema appeared, accompanied by hardening and swelling of the skin on the back. The affected area became red and some purplish subcutaneous nodules appeared in the center of the indurated lesions. Progressively, similar lesions developed on the both shoulders and

the upper arms (Fig. 2). He was referred for consultation to the department of dermatology.

A biopsy specimen from the abdomen showed a characteristic histological finding of subcutaneous fat necrosis of the newborn with variable sized adipocytes and needle-shaped empty clefts lying singly or in a radial arrangement within the fat cells. At the periphery of the fat lobules, considerable infiltrations of lymphocytes, histiocytes, fibroblasts and some foreign body giant cells were seen in some foci throughout the lobules (Fig. 3).

The baby was discharged at the age of 30 days with a generally improved condition. The nodules and infiltrates involuted gradually and by the age of 6 months the skin had an entirely normal appearance. The physical and neurological examinations were both normal without any sequelae.

At 9 months of age, the infant was continuing to do well and the cardiomyopathy had much improved.

**Fig. 1.** A chest radiograph showed moderate cardiomegaly.

**Fig. 3.** Typical needle shaped cleft with radial arrangement in fat cells, and a large numbers of lymphohistiocytes and some multinuclear giant cell infiltrations in the fat lobules(H&E stain  $\times 200$ ).

## DISCUSSION

Subcutaneous fat necrosis of the newborn is an uncommon disorder characterized by localized, firm, purple-red, subcutaneous nodules present on the cheeks, back, buttocks and thighs<sup>1</sup>. Histopathological examination shows areas of fat necrosis in the subcutaneous tissue infiltrated by inflammatory cells and usually by foreign-body giant cells. Many of the remaining fat cells, as well as the giant cells, contain needle-shaped clefts that often lie in a radial

**Fig. 2.** Well demarcated multiple subcutaneous erythematous indurated nodules on both the shoulders and the back.

arrangement<sup>3</sup>. Occasionally diffuse calcification is demonstrated histopathologically and radiologically<sup>11</sup>. The diagnosis of subcutaneous fat necrosis of the newborn is made both clinically and histologically. Our patient had typical skin lesions and histological findings, and in addition, he suffered from hypoxic cardiomyopathy.

Differential diagnosis in this patient includes sclerema neonatorum and cold panniculitis. In cold panniculitis, there is a consistent relationship between erythematous indurated nodules and plaques which invariably appear within 48 to 72 hours of cold exposure and can be experimentally reproduced<sup>12</sup>. However, in cold panniculitis, lipocytes and giant cells filled with triglyceride crystals were not found. Sclerema neonatorum causes diffuse hardening of the skin that is associated with a grave prognosis. Needle-shaped clefts may also be found in the fat cell of sclerema neonatorum, but lack the associated inflammatory response of subcutaneous fat necrosis of the newborn<sup>13</sup>.

Many etiological factors have been associated with subcutaneous fat necrosis of the newborn. However, the precise cause of subcutaneous fat necrosis of the newborn has not been established. A variety of insults, for example maternal preeclampsia, maternal diabetes, obstetric trauma, fetal as-

phyxia, cold or induced hypothermia, hyperprostaglandinemia, and pancreatitis have been considered<sup>14</sup>. Pasky<sup>15</sup> has suggested that asphyxia and obstetrical trauma are the most common factors in subcutaneous fat necrosis of the newborn. Salas Valien et al.<sup>16</sup> suggest that this disorder should be regarded as a pluri-etiological syndromic complex, and not as a disease with a single etiology. Many authors have proposed theories to explain the pathogenesis of this entity, e.g. an increased ratio of saturated to unsaturated fatty acids<sup>17</sup>, protease-antiprotease imbalances<sup>18</sup> and brown fat deficiency<sup>19</sup>. Some authors hypothesized that subcutaneous fat necrosis of the newborn may result from a peripheral oversupply of saturated fatty acids in combination with exposure of skin adipocytes to lower temperatures. In neonates the subcutaneous triglycerides contain lesser concentrations of unsaturated fatty acids and therefore have a higher melting point than in adults<sup>20</sup>.

Norwood-Galloway et al.<sup>21</sup> in 1987, reported a case with subcutaneous fat necrosis of the newborn and hypoxic cardiomyopathy at birth. In our patient, fetal asphyxia, the most common finding associated with subcutaneous fat necrosis of the newborn<sup>13</sup>, had contributed to the occurrence of subcutaneous fat necrosis of the newborn and also the cardiac output was compromised due to cardiomyopathy which might have aggravated the hypoxic condition. In this case it could be speculated that cardiomyopathy-induced systemic hypoxia gave rise to hypothermia of the skin as a result of peripheral vasoconstriction.

Compared with the 7 cases already reported in Korean literature (Table 1)<sup>13,9</sup>, there are two cases that had some organic diseases such as hypoxic-ischemic encephalopathy which were secondary to birth trauma, especially neonatal asphyxia.

It might be postulated that an underlying defect in fat composition and metabolism, which has not yet been adequately defined, coupled with a variety of internal and external stresses may act in unison to produce this cutaneous manifestation in the affected newborn. Further investigations of fat metabolism in neonates with subcutaneous fat necrosis and more cautious approaches to the etiological factors, analysing underlying organic diseases such as cardiomyopathy, are needed.

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