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# Effect of Fresh Blood Transfusion in The Treatment of Sclerema Neonatorum

*by*

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## Introduction

There is still confusion in the proper knowledge of Sclerema. At least 3 different conditions with induration of the subcutaneous fat in the neonatal period and in the first months of life exist which are called Sclerema (Djojodiguno, 1965; Nelson, 1959). In this paper, sclerema neonatorum is defined as a condition characterized by a diffuse rapidly spreading, non-oedematous, tallow-like hardening of the subcutaneous tissue of infants in the first weeks of life. The skin of the involved areas cannot be picked up and the subcutaneous tissue seems fixed on to the subjacent muscles and bones (Hughes and Hammond, 1948).

The etiology, pathogenesis and treatment of sclerema neonatorum are still obscure and the prognosis is very grave. Before the era of antibiotics and corticosteroids the mortality rate was 75% (Hughes and Hammond, 1948). Thereafter the treatment of sclerema neonatorum remains unsatisfactory. A mortality rate of 85% was reported in a recent series of 25 cases (Levin et al., 1961). Various authors (Djojodiguno, 1965; Levin et al., 1961; Warwick et al., 1963) concluded that corticosteroids were of little or no value. In the literature available to the authors, blood transfusion in the treatment of sclerema neonatorum is never mentioned, except by Warwick et al. (1963) who suggested it as a supportive procedure.

The group of cases presented in this paper are given transfusion with FRESH blood as part of the conventional treatment.

## Material and methods

During the period of April 1969 — October 1970 cases of sclerema neonatorum, admitted to the De-

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partment of Child Health, Dr. Soetomo General Hospital, Surabaya, for various diseases were collected (see tables 1 A through 2 C). As mentioned above, the diagnosis of sclerema neonatorum was confirmed based on the criteria of Hughes and Hammond (1948). All cases were generally in a bad condition. Next to the treatment of the underlying disease(s) fresh blood transfusions during 2 to 3 consecutive days were given, using type specific blood for each case in a dosage of 5 to 10 ml per kilogram body weight per day. The donor was either the parents or relative. The blood was drawn from the donor and directly put into 5 ml syringes containing 0,5 ml of a 3,8% solution of sodium citrate being the anticoagulant. The exact amount of blood needed daily was taken from the donor entirely and immediately given to the patient by intravenous fluid drip. Prior to the bloodtransfusion, glucosesaline solution was given by the same route. Next to bloodtransfusion the conventional treatment consisted of:

— Prednison : 3 — 5 mg per kilogram body weight per day
— Proper antibiotic therapy
— Proper nursing care

During the same period another group of 12 cases did not receive bloodtransfusion due to technical difficulties, such as lack of suitable donors. This group of patients received the same treatment except for the bloodtransfusion. (see tables 2 A through 2 C).

## Result

In total we had 41 cases of sclerema neonatorum, 24 were males and 17 females. The birth weights were unknown, but the body weight on admittance was measured. Twenty-three were less than 2500 grams, 18 were more than 2500 grams. Sixteen were admitted with the obvious presence of sclerema, whereas the remaining 25 developed it during hospitalization.

Accompanying diseases were:

— Gastroenteritis with severe dehydration in 31 cases
— Bronchopneumonia in 10 cases
— Peritonitis in 5 cases
— Malnutrition in 5 cases
— Moniliasis in 5 cases
— Purulent meningitis in 5 cases
— Sepsis in 2 cases
— Atresia oesophagii in 1 cases.

Very often, more than one illness were observed in patient e.g. gastroenteritis with moniliasis and malnutrition, gastroenteritis and bronchopneumonia, etc.

It was however striking that the majority of the cases were suffering from gastroenteritis with severe dehydration and acidosis. To analyse the results the series of patients were divided into 2 groups:

Group I : cases with blood transfusion, subdivided again into:

I A. Cases that survived (Table 1 A).

I B. Cases that died:

1. Sclerema resolved (Table 1 B)
2. Sclerema persisted or became more extensive (Table 1 C).

Group II : patients with no blood transfusion, subdivided again into:

II A. Survivals (Table 2 A).

II B. Deaths :

1. Sclerema resolved (Table 2 B).
2. Sclerema persisted or became more extensive (Table 2 C).

Tables 1A, 1B, 1C and 2A, 2B, 2C show summaries of the clinical data of patients. There were some cases shown in tables 1B and 2B in which the sclerema resolved gradually although the accompanying illness worsened.

In group I (with blood transfusion) the mortality rate was 60.7% whereas in group II (without blood transfusion) it was 75%. When we consider only the resolution of the sclerema the cure rates were for group I 53,5% and for group II 33.3%.

*Case illustration:*

*Case No. 6:*

A 2-day-old boy was admitted to the hospital; the infant had been delivered by an indigenous mid-wife without any complication. The birth weight was not known.

On admission the body weight was 3290 grams. The patient did not pass stools since birth and vomited after every feeding. The vomit was green in colour, no fever was observed. Physical examination revealed an ill infant with pronounced icterus. The rectal temperature was 37.6 dagrees Celcius, the pulse rate 120/min, the respiration rate 72/min. The abdomen was distended. No signs of obstructive ileus were found.

Peristaltic movements of the intestines were present but weak. The umbilicus was wet with signs of infection. Apparently the child suffered from omphalitis and paralytic ileus. The patient was fed by gastric tube, penicillin and streptomycin were administered. However, the condition deteriorated, the peristaltic movements of the intestines disappeared and the abdomen became more and more distended. Vomiting persisted.

After 3 days of hospitalization sclerema neonatorum was noted on the calves of the lower extremities which spread rapidly. Twenty-four hours later (fourth hospital day) it became very extensive. No passive movements were possible; the child appeared to be in a fixed position and the cry became very weak. Respiratory movements were shallow and rapid due to sclerema in the thoracic wall. Thereupon the child was given intravenous fluid, intravenous tetracyclin, 15 mg prednison orally and in addition 25 ml of fresh blood daily for 2 consecutive days. The condition improved rapidly, vomiting stopped and the infant started to pass stools, whereas peritonitis and omphalitis subsided along with resolution of the

sclerema. On the sixth hospital day (2 days after treatment with fresh blood transfusion) the sclerema disappeared entirely and oral feeding was tolerated. On the tenth hospital day the patient could be discharged in a good condition with a body weight of 3410 grams.

*Case No. 12*

This was a female premature baby who was born spontaneously with a body weight of 1910 grams. A very large omphalocèle was present at birth and surgical correction of the anomaly was performed.

At the age of 6 days the patient was transferred to the Department of Child Health with a body weight of 1750 grams. Physical examination revealed a severely dehydrated baby with widespread sclerema involving practically the whole body except the palms and soles. Respiration was very shallow and the pulse was rapid and weak. The abdomen was distended and surgical wound in the abdomen wall showed signs of infection. Rectal temperature was 36.5 degrees Celcius. The diagnosis of peritonitis was suspected with paralytic ileus and sclerema neonatorum. A saline glucose intravenous fluid drip was immediately performed. Massive doses of sodium crystalline Penicillin G, Streptomycin, Chloramphenicol were given.

Other therapeutic measures were:

— Fresh blood transfusion: 20 ml per day for 3 consecutive days.
— Prednison: 3 times 2.5 mgm per day orally.
— Special nursing care in an incubator, $O_2$ therapy, etc.

Rapid recovery was noted. On the following day no distention of the abdomen was observed and defaecation was present. The wounds on the abdominal wall became dry and along with this the sclerema began to resolve. On the third hospital day the child could be fed by mouth, the patient could suck vigorously, because the sclerema of the cheeks disappeared. On the fifth hospital day the sclerema was resolved entirely. However, on the sixth day the patient became dyspneic after a feeding and died 8 hours later, probably due to aspiration.

*Case No. 13*

A female premature with unknown birth weight was admitted when she was 17 days old. The body weight was 1370 grams, extensive sclerema was present on almost the whole body. The child also suffered from bronchopneumonia, gastroenteritis and dehydration.

Intravenous fluid drip therapy was performed next to:

— fresh blood transfusion of 20 ml per day for 2 consecutive days,
— Prednison 2 times 2.5 mg a day orally and
— Penicillin G sodium cryst. parenterally with tetracyclin orally.

On admission the child was dysp-

noeic and cyanotic with rapid and shallow respiration. Rectal temperature was 38.3 degrees Celcius. Over both lungs crepitations and moist rales were heard. The infant had often cough attacks followed by lowered consciousness. On the second hospital day the general condition remained the same except that a slight regression of the sclerema on the cheeks was noted. On the third day after the second blood transfusion, the sclerema diminished considerably, and disappeared absolutely in the upper extremities. The pneumonia, however, persisted, whereupon the therapy was switched into ampicillin and streptomycin.

On the fourth hospital day signs of marked infection on the site of the vena section appeared. However, the sclerema disappeared entirely despite the deterioration of the general condition. The child died on the seventh day with gangrene around the site of the vena section.

## Discussion

Whether sclerema neonatorum is considered as a disease entity or just as a symptom of a potentially fatal underlying disease, it is of the utmost importance to overcome the disorder as soon as possible. In the severe stage of sclerema the patient apparently cannot perform any movement and looks like to be "frozen" in a fixed position. Even the excursion of the thoracic wall for respiration is very limited. Therefore the acidosis accompanying the condition will be more severe. Sucking is also not possible. Thus, while sclerema accompanies severe illnesses, it imposes an extra burden on the baby.

Once sclerema appears in a certain area it tends to spread to the surrounding tissues at the rate of about 5 — 10 cm a day (Holt and Mc Intosh, 1962) meanwhile a new focus is apt to appear in another part of the body and those foci will finally join together. Within a very short period the whole body will be involved. Keeping this progress in mind combat of sclerema neonatorum as soon as possible is necessary along with vigorous treatment of the accompanying disease.

As the pathogenesis and etiology of the sclerema are not yet clearly understood, its treatment is still a problem. Numerous theories about etiology have been proposed (Djojodiguno, 1965). In our opinion the most acceptable are:

*1. Simple solidification of body fat.*

This solidification would be due to the fact that the body fat of the newborn contains less oleic acid but more palmitic and stearic acids (Pfaundier and Schlossman, 1935).

Another hypothesis is that the iodine content of the body fat of the newborn is low (Perlman, 1960).

These hypotheses may explain why newborn infants are prone to suffer from sclerema.

2. *Circulatory Stasis.*

Johnson (1969) stated that it appears most reasonable that sclerema neonatorum represents basically a state of perfusion failure and shock which may be derived from a multiplicity of possible cause, such as hypovolemic shock (due to hemorrhage, dehydration, septicemia, respiratory failure, etc.).

This state of low perfusion will cause redistribution of blood in the body; the vital organs still receive blood, while less important organs such as the skin will undergo hypoxia/anoxia.

This will cause derangement of the cell metabolism. Ultimately characteristic hardening of the skin in sclerema neonatorum will take place due to alteration and thickening of the collagen fibres of the connective tissue, with the histologic finding of thicker fibrous trabeculae and diminished fat spaces of the subcutaneous layer (Djojodiguno, 1965; Perlman, 1960).

Hughes and Hammond (1948) found acidosis and hypocalcemia in their sclerema neonatorum patients, whereas Cambell and Dales (1952) noted the presence of elevation of blood ureum until 900 mg/100 ml in their series, and Levin (1961) encountered high blood ureum levels, high potasium content and marked decrease of $CO_2$ combining power. These laboratory data show the evidence of shock in patients with sclerema neonatorum and thus supporting the circulatory stasis theory.

To combat sclerema neonatorum we have to correct the low perfusion state and shock as soon as possible. With the recent advances made in the study of shock, it is known that massive doses of corticosteroids are of great value in the treatment of shock (Ashford et al., 1966; Fine et al., 1968; Lefer and Martin, 1969; Wilson and Fisher, 1968). We may therefore expect that corticosteroids in the treatment of sclerema neonatorum will give a better outcome.

The use of blood in the management of shock has been strongly recommended (Johnson, 1969); since bank blood may develop high lactate levels with long time of storage. we preferred fresh blood. These infants already being in a state of acidosis, the use of bank blood could aggravate the acid base imbalance.

The beneficial effects of fresh blood in sclerema neonatorum might be:

1. To combat the low perfusion state and shock.
2. The presence of a buffer system in the blood may correct acidosis.

3. The presence of immune bodies in the blood may be of value in these severely ill babies.

Table 3 shows the mortality and cure rates of group I (with blood transfusion), group II (without blood transfusion) and the group of Levin and Milunski's (1965). The mortality rate in our series of group I is more favorable as compared with that of group II and of the Levin and Milunski's group. Even more pronounced is the difference in the cure rate. Since groups I and II in our series are similar in condition, the conclusion could be drawn that better result achieved in group I might possibly be due to the transfusion with fresh blood.

Levin and Milunski's series did not receive blood transfusion at all. From the series of our patients it is noticed that worsening of the underlying disease does not parallelly cause the sclerema more pronounced. There were cases who died, in which the sclerema however disappeared entirely (see tables IB and 2B).

## Summary

Two groups of patients suffering from sclerema neonatorum were differently treated and followed up. Next to treatment of the accompanying disease, both groups received corticosteroids and intravenous fluid drip therapy. The first group got fresh blood transfusion additionally whereas the second group serving as control did not get blood transfusion.

It appeared that the mortality rate in the blood transfusion group was lower than in the other group. The cure rate was also higher. It was also observed that resolution of the sclerema did not necessarily accompany improvement of the accompanying disease.

The authors conclude that fresh blood transfusion may show beneficial effect in regression or resolution of sclerema in newborns.

TABLE 1 A : *GROUP I (with fresh blood transfusion).*

| Case no. | Sex | Body weight (gm) | | Age on admission | Onset of Sclerema |
|---|---|---|---|---|---|
| | | on admission | at birth | | |
| 1 | ♂ | 1956 | 2800 | 18 days | 2nd hospital day |
| 2 | ♀ | 1841 | 2300 | 16 days | sclerema positive on admission |
| 3 | ♀ | 2106 | ? | 50 days | ,, |
| 4 | ♂ | 2466 | ? | 7 days | 2nd hospital day |
| 5 | ♀ | 2240 | 2690 | 20 days | 3rd hospital day |
| 6 | ♂ | 3290 | ? | 2 days | 3rd hospital day |
| 7 | ♂ | 1800 | 3200 | 17 days | 2nd hospital day |
| 8 | ♂ | 4400 | 3500 | 60 days | 2nd hospital day |
| 9 | ♀ | 2041 | ? | 19 days | Sclerema positive on admission |
| 10 | ♂ | 1790 | 2700 | 18 days | ,, |
| 11 | ♂ | 2185 | 3350 | 45 days | ,, |

TABLE 1 B : *GROUP I (with fresh blood transfusion)*

| Case no. | Sex | Body weight (gm) | | Age on admission | Onset of Sclerema |
|---|---|---|---|---|---|
| | | on admission | at birth | | |
| 12 | ♀ | 1750 | 1910 | 6 days | Sclerema positive on admission |
| 13 | ♀ | 1370 | ? | 17 days | ,, |
| 14 | ♂ | 1946 | 2660 | 13 days | 4th hosp. day |
| 15 | ♀ | 1835 | 2008 | 14 days | Sclerema positive on admission |

*4 patients who died, but showed resolution of the sclerema*

| Associated illnesses | Therapy | Results |
|---|---|---|
| Post operative omphalocele + Peritonitis + paralytic ileus | I.V. Fluid Therapy Fresh blood tranfusion — Prednison — Antibiotics | Died on 6th hosp. day due to aspira tion. Sclerema resolved within 5 day |
| Bronchopneumonia + dehydration Gastroenteritis | -„- | Died on 7th hosp. day due to gang rene of the leg. Sclerema resolve within 3 days |
| Gastroenteritis + dehydration | -„- | Died on 9 th hosp. day due to re currence of diarrhoea. Sclerema re solved within 3 days |
| Gastroenteritis, Bronchopneumonia dehydration | -„- | Died on 9th hosp. day due to gang rene of the leg. Sclerema resolve within 4 days |

*11 patients who survived with resolution of the sclerema*

| Associated illnesses | Therapy | Results |
|---|---|---|
| Gastroenteritis dehydration + thrush. | I.V. Fluid therapy, Fresh blood, Prednison, Antibi-otics. | Sclerema resolved within 4 days |
| Gastroenteritis + dehydration | -„- | Resolved within 4 days |
| Gastroenteritis dehydration + thrush. | -„- | Resolved within 4 days |
| Omphalitis + Peritonitis, Paralytic ileus. | -„- | Resolved within 5 days |
| Gastroenteritis + malnutrition | -„- | Resolved within 7 days |
| Gastroenteritis dehydration | -„- | Resolved within 5 days |
| Gastroenteritis dehydration | -„- | Resolved within 3 days |
| | I.V. Fluid | Resolved within 6 days |
| Dehydration (Starvation) | -„- | Resolved within 4 days |
| Gastroenteritis + malnutrition | -„- | Resolved within 6 days |
| | -„- | Resolved within 4 days |

TABLE 1 C : *GROUP I (with fresh blood transfusion)*

| Case no. | Sex | Body weight (gm) | | Age on admission | Onset of Sclerema |
|---|---|---|---|---|---|
| | | on admission | at birth | | |
| 16 | ♂ | 3487 | ? | 60 days | 14th hosp. day |
| 17 | ♀ | 2296 | ? | 15 days | Sclerema positive on admission |
| 18 | ♂ | 2400 | 2360 | 2 days | " |
| 19 | ♀ | 2074 | 2800 | 16 days | 14th hosp. day |
| 20 | ♂ | 3570 | ? | 14 days | 3rd hospital day |
| 21 | ♂ | 2892 | ? | 13 days | 10 hours after admission |
| 22 | ♂ | 5500 | ? | 60 days | 0th hosp. day |
| 23 | ♂ | 2013 | ? | 60 days | 3rd hosp. day |
| 24 | ♀ | 4905 | ? | 120 days | Sclerema positive on admission |
| 25 | ♀ | 2807 | 3250 | 45 days | 3rd hospital day |
| 26 | ♀ | 2296 | 2750 | 11 days | 5th hosp. day |
| 27 | ♂ | 2466 | 2820 | 13 days | 2nd hosp. day |
| 28 | ♀ | 3147 | ? | 120 days | Sclerema positive on admission |

*13 patients who died with worsened sclerema*

| Associated illnesses | Therapy | Results |
|---|---|---|
| Gastroenteritis (G.E.). + dehydration + Malnutrition | I.V. Fluid therapy, Fresh blood, Prednison, Antibiotics | Sclerema worsened<br>Died on 18th hosp. day. |
| G.E. + dehydration, Bronchopneumonia, Moniliasis | -„- | Sclerema remained<br>Died 46 hours after adm. |
| Purulent meningitis | -„- | Sclerema remained<br>Died 3 days after admiss. |
| G.E. + dehydration | -„- | Sclerema worsened.<br>Died 5 days after admiss. |
| Bronchopneumonia | -„- | Sclerema worsened.<br>Died on 4th hosp. day |
| G.E. + dehydration | -„- | Sclerema worsened.<br>Died 22 hours after admiss. |
| Purulent meningitis | -„- | Died 11 days after admiss.<br>Sclerema worsened. |
| G.E. + dehydration<br>Bronchopneumonia | -„- | Sclerema remained<br>Died on 4th hosp. day |
| G.E. + Bronchopneumonia | -„- | Sclerema remained<br>Died on 2nd hosp. day. |
| G.E. + Paralytic ileus | -„- | Sclerema remained<br>Died on 3rd hosp. day. |
| G.E. + Bronchopneumonia | -„- | Sclerema remained<br>Died on 6th hosp. day. |
| G.E. + Moniliasis | -„- | Sclerema remained<br>Died on 2nd hosp. day. |
| Malnutrition + G.E. | -„- | Sclerema remained<br>Died on 3rd hosp. day |

TABLE 2 A : *GROUP II (without blood transfusion)*

| Case no. | Sex | Body weight (gm) | | Age on admission | Onset of Sclerema |
|---|---|---|---|---|---|
| | | on admission | at birth | | |
| 29 | ♂ | 2977 | ? | 30 days | Sclerema positive on admission |
| 30 | ♂ | 2655 | ? | 10 days | 2nd hosp. day |
| 31 | ♀ | 3345 | ? | 45 days | 2nd hosp. day |

TABLE 2 B : *GROUP II (without blood transfusion)*

| Case no. | Sex | Body weight (gm) | | Age on admission | Onset of Sclerema |
|---|---|---|---|---|---|
| | | on admission | at birth | | |
| 32 | ♂ | 2225 | 2900 | 30 days | Sclerema positive on admission |

TABLE 2 C : *GROUP II (without blood transfusion)*

| Case no. | Sex | Body weight (gm) | | Age on admission | Onset of Sclerema |
|---|---|---|---|---|---|
| | | on admission | at birth | | |
| 33 | ♂ | 3175 | 2900 | 130 days | Sclerema positive on admission |
| 34 | ♀ | 2778 | 2930 | 4 days | ,, |
| 35 | ♂ | 2600 | ? | 4 days | 2nd hospital day |
| 36 | ♀ | 2550 | 2700 | 21 days | 5th hosp. day |
| 37 | ♂ | 1800 | 2200 | 15 days | Sclerema positive on admission |
| 38 | ♂ | 1832 | 2490 | 20 days | 3rd hospital day |
| 39 | ♂ | 3090 | ? | 28 days | 16 hours after admission |
| 40 | ♀ | 2948 | 3300 | 27 days | 2nd hosp. day |

*3 patients who survived with resolution of sclerema*

| Associated illnesses | Therapy | Results |
|---|---|---|
| G.E. + dehydration + Otitis media purulenta acuta | I.V. Fluid ther. Prednison, Antibiotics | Sclerema resolved within 3 days |
| G.E. + dehydration | -„- | Sclerema resolved within 3 days |
| G.E. + dehydration | -„- | Sclerema resolved within 2 days. |

*One patient who died, but showed resolution of sclerema.*

| Associated illnesses | Therapy | Results |
|---|---|---|
| Bronchopneumonia<br>G.E. + Moniliasis | I.V. Fluid ther. Prednison, Antibiotics | Sclerema resolved on 4th hospital day, but died on the 7th hospital day due to gangrene of the leg. |

*8 patients who died with worsened sclerema*

| Associated illnesses | Therapy | Results |
|---|---|---|
| G.E. + dehydration<br>Malnutrition | I.V. Fluid ther. Prednison, Antibiotics | Sclerema remained. Died on 3rd hosp. day. |
| Atresia Oesophagii | -„- | Died 16 hours after admission, sclerema remained |
| Septicemia | -„- | Sclerema worsened. Died on 3rd hosp. day. |
| G.E. + dehydration | -„- | Sclerema worsened. Died on 6th hosp. day. |
| GE + dehydration + Moniliasis | -„- | Sclerema remained. Died on 3rd hosp. day. |
| Omphalitis + Peritonitis + G.E. dehydration | „ | Sclerema worsened. Died on 4th hosp. day. |
| Sepsis | „ | Sclerema worsened. Died on 2nd hosp. day. |
| Bronchopneumonia | „ | Sclerema remained. Died on 2nd hosp. day. |

TABLE 3 : *Mortality rate and cure rate of our series of sclerema neonatorum patients compared with that of Levin.*

| | Our series of sclerema neonat. | | Levin's series (without blood transfusion) |
|---|---|---|---|
| | Group I | Group II | |
| Mortality rate | 60.7% | 75% | 84 % |
| Cure rate | 53.5% | 33.3% | 24% |

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