
Case Reports

DISAPPEARANCE OF HEMOLYTIC STAPHYLOCOCCUS AUREUS SEPTICEMIA FOLLOWING ULTRAVIOLET BLOOD IRRADIATION THERAPY*

KNOTT TECHNIC

GEORGE MILEY, M.D.

Clinical Professor of Pharmacology, The Hahnemann Medical College and Hospital
PHILADELPHIA, PENNSYLVANIA

THE following is a case report of a young student nurse who recovered rather dramatically from hemolytic violet blood irradiation therapy have been published, notably by Hancock and Knott,¹ Hancock,² Barrett,³ Miley,⁴⁻⁷ Miley and

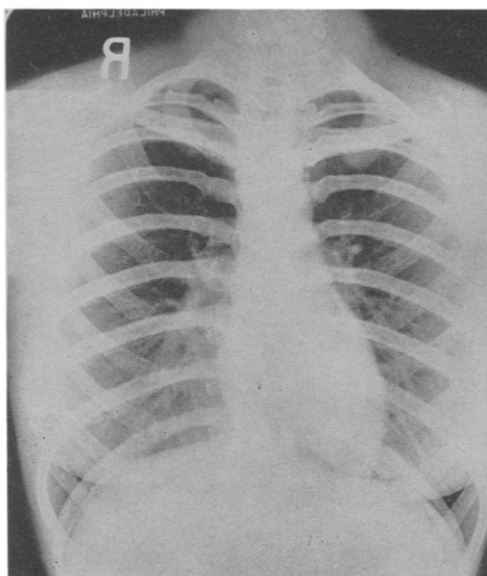


FIG. 1. Photograph of routine chest x-ray taken in October, 1942, six months previous to admission.

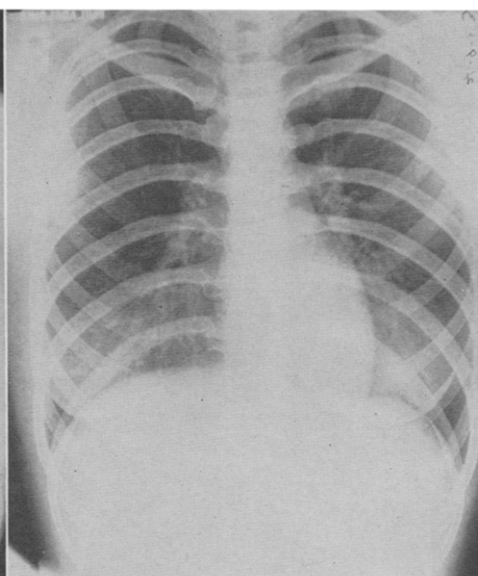


FIG. 2. Photograph of chest x-ray on day of admission (April 9, 1943), showing no demonstrable pulmonary disturbance although blood culture was positive at that time.

staphylococcus aureus septicemia following two applications of ultraviolet blood irradiation therapy (Knott technic).

In the last few years many accounts of the successful control of acute pyogenic infections by the Knott technic of ultra-

Rebbeck,⁸ Rebbeck,^{9,10} and Rebbeck and Walther.¹¹ Originally, we reported that seven individuals suffering from Staphylococcus aureus septicemia had received no benefit following the use of ultraviolet blood irradiation therapy,⁷ however, six

* From the Blood Irradiation Clinic, Hahnemann Medical College and Hospital, Philadelphia, Pennsylvania.

of these seven had received large amounts of sulfa drugs, and in one instance no transfusion whatsoever; furthermore all

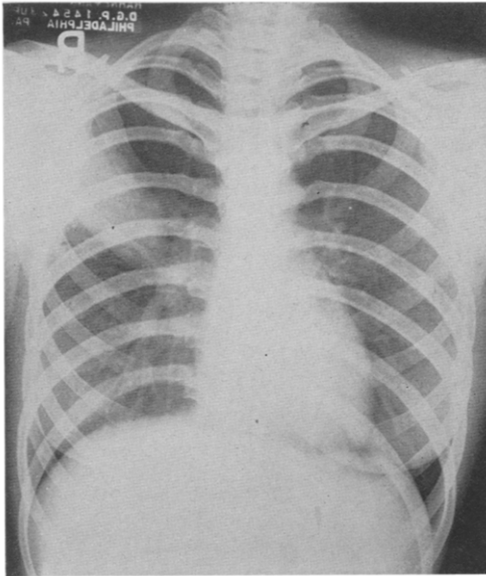


FIG. 3. Photograph of chest x-ray taken April 12, 1943, showing triangular consolidation at the periphery of the upper right pulmonary field; this was taken the same day as the second blood culture.

were considered terminal cases when first seen. The following case report shows clearly what can be accomplished in *Staphylococcus aureus* septicemia if ultraviolet blood irradiation therapy (Knott technic) is instituted early in the course of the disease, if whole blood transfusions are used as indicated, and if no sulfa drugs whatsoever are used.

The Knott technic has been described elsewhere and consists briefly of the withdrawal and citrating of a predetermined amount of a patient's blood, plus the immediate reinjection of the citrated blood through the Knott hemoirradiator, a precision machine which automatically exposes the citrated blood safely and efficiently to a high intensity source of ultraviolet rays, and reinjects it into the venous circulation of the patient.

In the last four and one-half years the Blood Irradiation Clinic of the Hahnemann Medical College and Hospital of Philadelphia has given over 3,000 blood irradiations,

and has observed no deleterious effects whatsoever, a fact which has allowed a much broader clinical trial in a much greater variety of clinical entities than would have been possible had there been any significant danger factor present.

CASE HISTORY

On April 9, 1943, a student nurse, age twenty, was admitted to the student nurse's infirmary complaining of chills, fever, general malaise, severe cough, and severe chest pain. She gave a history of having been discharged from the local Municipal Contagious Disease Hospital on recovery from measles two days previous to admission.

Physical examination revealed an extremely toxic individual with a few vague râles in the right chest, a temperature of 104.2°F., pulse rate of 128, and her respiratory rate 28. X-ray examination revealed that both lung fields were entirely clear at this time. (Fig. 2.) Laboratory examination revealed: leukocyte count 21,400, erythrocyte count 4,580,000, hemoglobin 13.6 Gm., urinalysis negative. A tentative diagnosis of acute influenzal tracheobronchitis and/or pneumonitis was made at this time.

Codeine sulfate gr. $\frac{1}{2}$ and acetyl salicylic acid gr. 10 were given immediately on admission, but the patient's condition continued to deteriorate. Eight hours after admission a blood culture was taken, and ultraviolet blood irradiation therapy was instituted.

On the following morning the patient's temperature dropped to 99.6°F., her pulse to 78 and respiratory rate to 24. The patient's leukocyte count fell to 12,200, erythrocyte count 3,920,000; however, that afternoon the patient was seized with a severe chill and her temperature rose to 105.0°F., pulse to 156 and respirations to 30. Acetyl salicylic acid gr. 3, quinine sulfate gr. 1 were given. A blood culture taken in tryptose phosphate broth showed no gross evidence of bacterial organisms at the end of twenty-four hours.

The following day, the second postirradiation day, the patient's temperature fell slightly to 100.4°F., the pulse rate to within normal limits and the respiratory rate to normal; however, in late afternoon of this day the patient was seized by another severe chill, and her temperature rose to 104.2°F., pulse

rate to 126 but her respiratory rate remained normal. A blood culture taken in tryptose phosphate on April 9th was very slightly cloudy

Then we realized for the first time that we were dealing with a severe staphylococcal septicemia, and that in all probability the

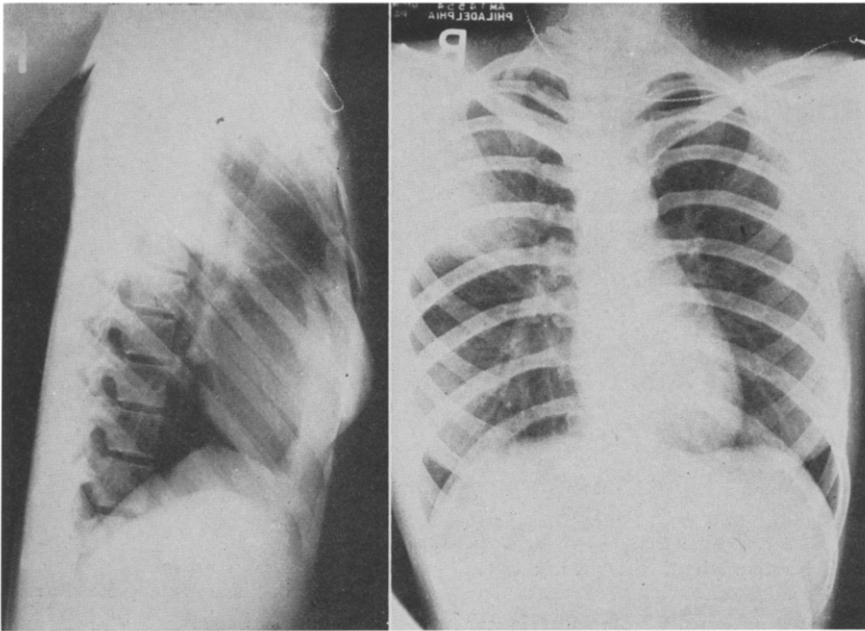


FIG. 4. Photograph of chest x-ray—anterior, posterior, and lateral views, taken April 15, 1943, showing slight resolution of triangular area of consolidation.

on gross examination at this time, after forty-eight hours incubation.

On April 12, 1943, the third postirradiation day, a second x-ray film of the chest (Fig. 3) revealed "a triangular area of pathological density in the peripheral portion of the right upper lobe where the markings suggested a beginning pneumonic consolidation." The patient's general condition had improved only slightly, if at all, during these three days, although her pulse rate had fallen perceptibly. Her leukocyte count had fallen to 6,650, erythrocyte count 3,345,000. A second blood culture was taken, and ultraviolet blood irradiation therapy was repeated; in addition a 250 cc. transfusion of whole blood was given, chiefly because the character of the pulse had changed slightly suggesting that a diminution in the circulating blood volume was occurring. Gross examination of the blood culture taken April 9th revealed definite cloudiness with beginning hemolysis. A slide made at this time showed presence of large clumps of staphylococci; subculture on Loeffler's medium demonstrated clearly the characteristic golden color of the bacterial organism.

triangular area of consolidation found in the right pulmonary field on x-ray examination was very possibly a septic infarct simulating an atypical lobar pneumonia. The fact that the blood culture taken on April 9th, the day of admission, was positive at the time that the chest x-ray was negative supported this diagnosis strongly. In addition, the patient's low almost normal respiratory rate was never compatible with that of lobar pneumonia.

On the first day following the second blood irradiation the patient's temperature remained elevated between 101.4° and 104.4°F., although her pulse and respiratory rates were definitely diminished. Her general condition seemed very slightly improved.

Forty-eight hours after the second blood irradiation the patient's temperature fell to normal; her pulse and respiratory rates continued to be normal. That evening her temperature rose to 102.6°F., her pulse and respiratory rates were normal, and the patient was markedly improved for the first time. The blood culture taken two days previously, April 12th, just before the second blood irradiation was slightly cloudy. The first blood culture

taken April 9th was now completely turbid and showed extensive hemolysis.

On April 15th, three days after the second

running toward the hilus and the base of the triangle at the periphery; lateral projection showed this area to be posterior to the middle

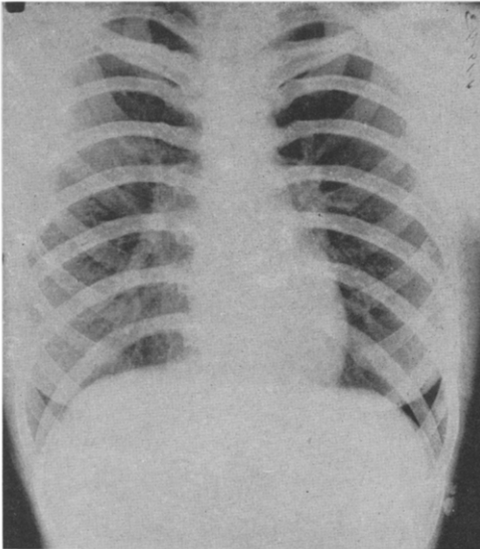


FIG. 5. Photograph of chest x-ray taken April 19, 1943, showing almost complete clearing of the pneumonic consolidation in the right upper lobe.

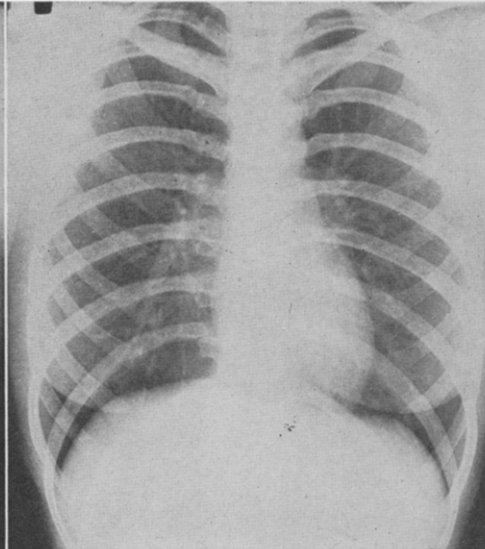


FIG. 6. Photograph of final chest x-ray taken April 23, 1943, shows complete clearing.

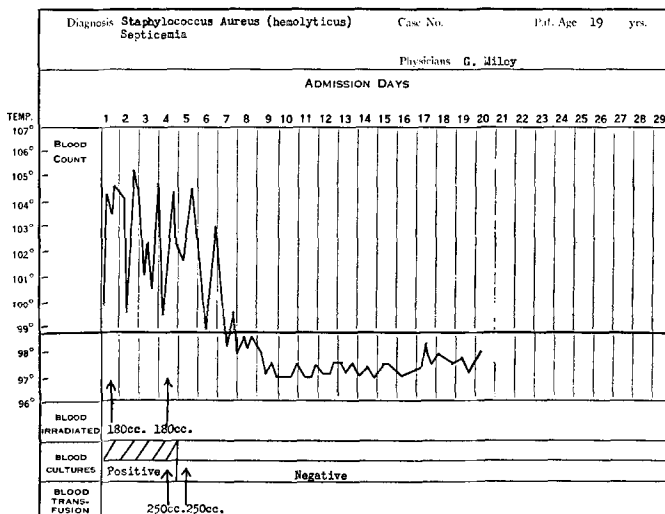


FIG. 7.

irradiation, the patient's temperature, pulse and respiratory rates were normal, and she convalesced uneventfully from this point on. X-ray examination of the pulmonary field (Fig. 4) on this day, April 15th, showed only early evidence of triangular consolidation in the lower portion, outer border of the right upper lobe, with the apex of the triangle

portion of the lung field; this consolidation had the appearance of a pneumonic process but not that of an abscess. The blood culture taken in tryptose phosphate three days previously now showed definite cloudiness but very little or no hemolysis. Microscopic examination at this time revealed the presence of staphylococci which showed much less

clumping than the original culture at the end of a similar seventy-two hour incubation period. Subculture on blood agar again revealed the presence of *Staphylococcus aureus*, and further subculture on Loeffler's medium again revealed strikingly the characteristic golden yellow of *Staphylococcus aureus*; the pigmentation was very slightly lighter in this second growth on Loeffler's than was the case of the organism isolated from the first culture.

A chest x-ray taken April 19th showed almost complete clearing of the pneumonic consolidation in the right upper lobe (Fig. 5) and a final x-ray taken April 23rd showed complete resorption of the pneumonic process involving the right upper lobe with no evidence of parenchymal inflammatory change at this time. (Fig. 6.) Subsequent blood cultures taken April 21st and 22nd were sterile. It was found that the erythrocyte count has risen to 4,000,000 and the leukocyte count had remained almost stationary at 6,400. The patient's convalescence was quite uneventful, and she left the hospital in apparent excellent condition April 28, 1943, nineteen days after admission. The patient returned to the hospital one month later, and upon physical and x-ray examination was found to be in excellent general condition.

The effects on the septic temperature in this case can be easily observed from the accompanying peak temperature graph (Fig. 7), in which the highest and the lowest temperature for each day is portrayed.

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