

ULTRAVIOLET BLOOD IRRADIATION THERAPY*

FURTHER STUDIES IN ACUTE INFECTIONS

GEORGE MILEY, M.D. AND JENS A. CHRISTENSEN, M.D.

PHILADELPHIA, PENNSYLVANIA

IN the study of 445 consecutive and unselected cases of acute pyogenic infections and seventy-four cases of virus or virus-like infections we have found that our original observations^{1,2} have been definitely confirmed and that not only sulfa-resistant infections have responded to this therapy but a high percentage of penicillin-resistant infections have also responded quite favorably.

In addition, we have observed that toxemias due to various virus or virus-like infections subside rapidly and in the same manner as those secondary to acute pyogenic infections,^{3,4} an extremely important clinical advantage in dealing with a rapidly fulminating and overwhelming infection, the etiological agent of which is frequently discovered or suspected only after death has occurred.

TABULAR REPORT

The following tabular report including a wide variety of acute pyogenic infections is as follows:

RESULTS IN 445 CASES OF ACUTE PYOGENIC INFECTION GIVEN ULTRAVIOLET BLOOD IRRADIATION THERAPY AT THE HAHNEMANN HOSPITAL, PHILADELPHIA, OVER A PERIOD OF SIX AND ONE-HALF YEARS

	No. of Cases	Recovered	Died
Early			
Puerperal sepsis.....	3	3	
Incomplete septic abortion...	12	12	
Acute furunculosis and carbunculosi.....	15	15	
Abscesses.....	2	2	
Acute Strep. hemolytic oropharyngitis.....	5	5	
Acute tracheobronchitis.....	12	12	
Acute wound infections.....	2	2	
Acute pansinusitis.....	1	1	
Acute pyelitis.....	1	1	
Acute otitis media.....	2	2	
Fever of unknown origin.....	1	1	
Moderately advanced			
Puerperal sepsis.....	14	14	
Incomplete septic abortion.....	57	57	

	No. of Cases	Recovered	Died
Acute furunculosis and carbunculosi.....	21	21	
Abscesses.....	13	13	
Acute Strep. hemolytic oropharyngitis.....	5	5	
Endometritis and parametritis.....	17	17	
Acute wound infections.....	6	6	
Salpingitis.....	15	15	
Peritonitis.....	18	16	2
Osteomyelitis.....	26	25	1
Fever of unknown origin.....	13	13	
Lobar and bronchopneumonia.....	11	11	
Atypical (virus) pneumonia.....	10	10	
Preoperative.....	13	13	
Postoperative.....	44	41	3
Non-healing wounds.....	6	6	
Thrombophlebitis.....	34	34	
Apparently moribund			
Puerperal sepsis.....	4	3	1
Incomplete septic abortion.....	2	1	1
Generalized peritonitis.....	4	2	2
Abscesses: Pelvic.....	6	5	1
Rectal.....	2	1	1
Scrotum.....	1	1	
Wound infections.....	3	2	1
Fever of unknown origin.....	2	1	1
Lobar and bronchopneumonia.....	2	1	1
Tb. meningitis.....	3		3
Mesenteric thrombosis, diabetes mellitus.....	1		1
Septicemias:			
Staph. aureus—albus with sulfa drugs.....	7		7
without sulfa drugs.....	9	9	
Str. hemolyticus.....	3	3	
Str. non-hemolyticus.....	2	1	1
Str. viridans—subacute bacterial endocarditis.....	13		13
Str. hemolyticus endocarditis.....	1		1
Str. non-hemolyticus endocarditis.....	1		1

Summary	Early	Moderately Advanced	Apparently Moribund
Number of cases.....	56	323	66
Number recovered.....	56	317	30
Percentage recovered.....	100%	98%	45%

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

RESULTS IN 74 CASES OF VIRUS OR VIRUS-LIKE INFECTIONS

	No. of Cases	Recovered	Died
Early			
Primary atypical or "virus" pneumonia.....	2	2	
Poliomyelitis			
Bulbo spinal type.....	0	0	
Spinal type.....	36	36	
Moderately advanced			
Primary atypical or "virus" pneumonia.....	11	11	
Poliomyelitis (non-toxic)			
Bulbo spinal type.....	4	4	
Spinal type.....	11	11	
Mumps.....	1	1	
Apparently moribund			
Primary atypical or "virus" pneumonia.....	2	2	
Poliomyelitis			
Bulbo spinal type.....	7	6	1

The poliomyelitis patients were consecutively treated in an epidemic in which the mortality of the untreated acute bulbar cases exceeded 40 per cent, as opposed to that of 9 per cent in the cases above.

CASE REPORTS

CASE I. No. 79317½. S. H. A female, aged fifty-four, was admitted to Hahnemann Hospital, Philadelphia, Pennsylvania on July 5, 1942. She was not acutely ill before being admitted but was complaining of a severe pain in the right side and a full burning sensation in the rectum. Her temperature was 103°F., with no vomiting and no nausea. Laboratory data were as follows: hemoglobin 13.8, red blood count 4,360,000, white blood count 10,000, polymorphonuclears 80 per cent and lymphocytes 20 per cent. Respiration was 20, pulse 110 and blood pressure 110/66.

Abdominal examination revealed marked tenderness in the right and left lower quadrant, but no gallbladder tenderness and no costo-vertebral tenderness. Rectal examination revealed tenderness and a possible mass near the rectal-sigmoid junction.

Given sulfathiazole, 15 grains every four hours, her condition improved, but on her eleventh hospital day her temperature began to rise again with chills, the rises being of a characteristic spiking nature. Blood cultures, however, were negative as was the Widal.

The red blood count deteriorated to 1,970,000, white blood count to 7,300 and hemo-

globin to 6.8. Frequent blood transfusions were necessary. X-ray showed either an acute diverticulitis or a walled off pocket in connection with the sigmoidal lumen.

On August 3, 1942, her temperature rose to 104.2°F. The patient was sigmoidoscoped and a large amount of pus drained from an abscess at the rectosigmoid junction. In spite of this the patient's temperature did not subside, and when seen on August 6th, was apparently moribund with Cheyne-Stokes respiration, showing a rapidly falling blood count, a temperature of 104°F, increasing toxemia and a rapid spread of the infection. The patient was semi-comatose, anuric, edematous and in early shock. Her extremely toxic condition was believed to be due to two factors: (1) overwhelming toxemia of bacterial infection, (2) the toxic effects of sulfathiazole, which failed to control infection.

Ultraviolet blood irradiation therapy with 200 cc. of citrated blood was given, and sulfa drugs were stopped; the patient's condition improved with supportive fluids and blood transfusions during the next forty-eight hours. Her temperature dropped to a level of 101°F to 102°F. The toxic condition subsided slightly and the patient was more rational, taking some food and voiding normally for the first time in more than a week.

On August 10, 1942 a second ultraviolet blood irradiation with 275 cc. of citrated blood was given after which the patient's temperature receded to nearly normal with a marked improvement in her general condition. The white count rose to 11,700 from the pre-irradiation value of 6,000. The patient now had normal bowel movements, ate well and regained strength. Rectal examination produced no more pus, but a mass in the sigmoid could still be felt.

On August 19th, the patient's temperature, pulse and respiration rose to 102°F, 130, 38 respectively and her condition deteriorated somewhat. The white blood count was 9,600.

Another ultraviolet blood irradiation of 275 cc. of citrated blood was given to which the patient responded in forty-eight hours with a normal temperature, a subsidence of toxic symptoms, lowered pulse and respiratory rate to 100 and 20 respectively.

The diagnosis was para-rectal abscess, and perforation of sigmoid diverticulum with abscess formation, rapid spread of infection.

The patient made an uneventful recovery and was discharged two weeks later on September 2, 1942, in apparently good condition.

CASE II. No. 83812. V. P. A female patient, aged fifty-nine, was admitted to the McKinley Hospital, Trenton, New Jersey, on July 18, 1944, suffering from an acute cholecystitis with a temperature of 102°F.

A cholecystectomy was planned after her acute symptoms had subsided. She was, therefore, immediately put on sulfathiazole 15 grains every four hours and 20,000 units of penicillin every four hours day and night. The sulfa drug level was kept between 2 mg. per cent to 6 mg. per cent for two weeks. On the second day an additional 30,000 units of penicillin were given by vein. This therapy was supported by blood transfusions of 250 cc. on the fifth, sixth, seventh and eighth hospital days.

In spite of this intensive therapy the patient's condition became increasingly critical and her temperature curve was definitely of a septic nature. Blood cultures were negative, urine was negative, blood chemistry normal, red count 4,350,000, white count 10,050 and hemoglobin 93 per cent. All agglutination tests were negative and Wassermann was negative.

On the twelfth day another 100,000 units of penicillin were given intravenously with a 500 cc. blood transfusion, as a rectal hemorrhage had occurred the day before.

On the fourteenth day the patient was considered hopelessly moribund by her attending physicians. She was semi-comatose, irrational and anuric. Her body was covered with a macular rash and there was noted an extensive edema of the eyes, face and ankles. At 6 P.M. of that day ultraviolet blood irradiation therapy, (250 cc. of citrated blood), was given and sulfa drugs stopped. The patient's temperature was 106°F. at this time. At 10 P.M. her temperature rose to 108°F. with chills. One-half hour later, however, her temperature began to drop, as profuse sweating appeared. Urine was passed for the first time in forty-eight hours. The following morning the patient became rational again. About eighteen hours after ultraviolet blood irradiation therapy her temperature dropped to 97°F., rising that evening to 101°F. In the next four days the patient made a most remarkable recovery; her temperature stayed normal, the rash disappeared, her appetite improved and all

tenderness in the gallbladder region subsided. Normal amounts of urine were voided consistently. Penicillin, 20,000 units every four hours were continued after ultraviolet blood irradiation therapy. In spite of this the patient developed signs of a beginning hypostatic pneumonia of the right lower lobe with temperature up to 102°F., on the sixth and seventh days after ultraviolet blood irradiation therapy. Another application of ultraviolet blood irradiation therapy with 250 cc. citrated blood was given at this time, eight days after the first; the symptoms of pneumonia subsided promptly after forty-eight hours.

The diagnosis was acute fulminating cholecystitis with overwhelming toxemia.

The patient made an uneventful recovery and was discharged on the twenty-ninth day without an operation being considered necessary and to date has shown no signs of cholecystitis.

CASE III. No. 79187. T. N. A male, fifty years of age, was admitted to the McKinley Hospital, Trenton, New Jersey, on May 5, 1943, for treatment of rheumatoid arthritis. He progressed favorably until May 31st, at which time gold thiocyanate was started, but withdrawn as the patient became acutely ill with fever, chills, and temperature of 104°F. Two days previous to this flare-up the patient had a tooth with infected roots extracted, and blood culture taken at this time was positive for *Streptococcus viridans*. He became progressively worse during the following four days despite intensive sulfathiazole therapy.

It was believed by the patient's physician that the prognosis was grave, as the patient had become semi-comatose and irrational. Ultraviolet blood irradiation was recommended as a last resort and was given on June 4, 1943, as soon as sulfathiazole was withdrawn. This was followed by a most dramatic result. The patient's temperature began to fall and in twenty-four hours he was apparently out of danger and at the end of forty-eight hours his temperature was normal and blood cultures were negative. The patient convalesced uneventfully and left the hospital in good condition on June 31, 1943.

The diagnosis was *streptococcus viridans* septicemia.

He has received thirteen blood irradiations since that time, the last one given on April 13, 1946. His rheumatoid arthritis is well con-

trolled and to date there has been no sign of *Streptococcus viridans* present in the blood stream for two years and ten months after his attack of *Streptococcus viridans* septicemia.

CASE IV. No. 851702. R. G., a fourteen-year old male, was admitted to the hospital October 21, 1943, with extensive enlargement of the right parotid area, slight early enlargement of the left parotid and temperature of 102°F. The condition had lasted for twenty-four hours and was diagnosed as mumps.

Ultraviolet blood irradiation therapy using 200 cc. of the patient's blood plus 40 cc. sodium citrate was given October 21st. Slight or mild toxemia was present. On the twenty-second he showed marked improvement twenty-four hours after irradiation. The swelling on the right side was less, and the left side subsided completely. The temperature was 99.0°F. The patient felt better, had a good appetite and ate a full breakfast. On the following day his temperature was 98.6°F, and the swelling on right side was less. The patient was discharged October 30, 1943; all swelling had completely disappeared.

CASE V. No. 21168. R. C. a seventeen year old male, a post-scarlet fever patient was admitted to U.S. Public Health Service Hospital, Sheepshead Bay, New York, on April 9, 1945. He complained of a productive cough for the past two weeks and of pain in the left lower chest on deep breathing during the previous week.

His temperature on admission was 105°F. and his physical examination revealed râles, dullness and diminished breath sounds over the left lower lung.

The following day his temperature dropped to normal and he did not seem ill; x-ray examination showed only a small area of patchy infiltration of the left lower lung field at the cardiophrenic angle. He convalesced uneventfully until on the fourteenth hospital day his temperature began to rise and penicillin was begun. In forty-eight hours his temperature had risen to 105°F. and he was definitely toxic. In another forty-eight hours the patient had become comatose, had renal failure, a blood pressure of 150/90, blood urea nitrogen of 82, blood sugar of 266, carbon dioxide combining power of 34; a diagnosis of acute nephritis was made. On the following day he developed muscular twitching. He came out of the coma but only temporarily. He began to

show evidence of increasing pulmonic complications despite the vigorous use of penicillin, so much so that x-ray examination on May 4th, showed an extensive pneumonia involving the whole lower two-thirds of both lung fields plus a narrow effusion of the right chest, causing 20 per cent compression of the right lung and probable pleuritic reaction of the lower one-third of the left chest. The pneumonic process became increasingly severe for the next four days and since it was apparent from the sputum findings that a penicillin-resistant hemolytic streptococcus was the causative organism, it was believed that the youth was apparently moribund and the prognosis extremely grave. A three-day trial of sulfadiazine had also been ineffective. Due chiefly to its availability, ultraviolet blood irradiation therapy was instituted on May 8th, at which time the patient's temperature was 104.2°F., pulse 120, respiration 36; the patient was semi-comatose and irrational.

The diagnosis was *Streptococcus pneumoniae*, glomerular nephritis and secondary hypertension.

On the first post-irradiation day the patient seemed slightly improved. In forty-eight hours he was less toxic and more rational, though still quite dyspneic. His temperature remained about 101°F. By the fourth post-irradiation day he was definitely improved though still moderately dyspneic and complaining slightly of pleuritic pain. His color had improved.

On May 14th, x-ray examination showed a moderate clearing of the left pleural sac and a diminished pocket in the right. The diagnosis was "resolving bilateral pneumonia." His general condition continued to improve; his temperature had fallen to a level between 98.4°F. and 100.4°F.

Further x-ray examination on May 17th, showed the continued resolution of the bilateral pneumonia with a narrow layer of fluid between the right lung and chest wall and right diaphragm. After May 16th, the patient's temperature failed to rise beyond 99°F., his blood pressure, now normal, also remained normal.

A certain amount of pleuritic reaction remained, and a small amount of fluid could be observed May 24th.

Penicillin, which had been continued empirically and possibly to some extent detrimentally, was finally discontinued May 26 1945.

All dyspnea had disappeared but some tachycardia remained; although on May 29th, there was still some fluid in both lungs, the patient's general condition remained excellent and his lungs finally cleared to the extent that he was discharged in good condition June 27, 1945.

CASE VI. No. 64360. D. G. an eleven-year old boy was admitted to Hahnemann Hospital, Philadelphia, August 8, 1942, with severe cough, chest pain, fever, toxemia and cyanosis. There was a history of cough and fever for six days previous to admission. Physical examination of chest revealed slight impairment of breath sounds over the right scapular area and fine crepitant râles over both apices. Laboratory examination showed a blood count of 4,040,000 red blood cells, 8,400 white blood cells, negative urinalysis and negative agglutination for *Bacillus typhoideus*, *Bacillus paratyphoideus*, A and B, *Bacillus abortus* and proteus OX 19. Sputum showed *Micrococcus catarrhalis* in predominance, no pneumococci on culture and the blood smear for *Plasmodium malariae* was negative. Roentgenological examination on August 31st, showed an acute inflammatory process extending into the lung fields from both hilar areas; a second chest x-ray taken September 2nd, showed further invasion by the acute inflammatory process in keeping with a definite deterioration of the child's general clinical condition after two to three days of hospitalization; at this time the red cell count had fallen to 3,460,000, the white count to 5,400.

The diagnosis was primary atypical or "virus" pneumonia with severe toxemia.

Since a virus type of progressing pneumonia was considered present, and no other therapy was believed effective, ultraviolet blood irradiation therapy was administered.

In twenty-four hours the patient's clinical condition was slightly improved, though x-ray examination revealed little change, if anything a slight progressing of the inflammatory process. The boy's temperature which had been 103.4°F. on the day of irradiation dropped to 100°F.

At the end of forty-eight hours the child's condition had greatly improved, his temperature fell to 98.6°F. for the first time and his severe toxic symptoms had completely subsided; a normal pink color had appeared and his cough seemed less severe. His red cell count

rose to 4,350,000, and his white count to 6,400. From then on he convalesced uneventfully and a roentgenological examination taken September 8th, showed a complete clearing of the lung fields; he left the hospital on that date, six days after a single blood irradiation.

CASE VII. No. 858545. L. T. a twelve-year old boy, when seen had moderate toxemia, some encephalitis manifestations present, temperature 103°F., marked back, bilateral hamstring and gastrocnemius spasm, weakness of both legs, left arm, inability to void and beginning of respiratory difficulty.

Blood Count	Spinal Fluid
White blood cells..... 13,000	Cells..... 180
Polymorphonuclears..... 80%	Pandy.... one plus
Hemoglobin..... 80%	

The diagnosis was spinal poliomyelitis with progression of muscular weakness.

Ultraviolet blood irradiation therapy was instituted October 31, 1943, using 165 cc. of the patient's blood plus 33 cc. sodium citrate. The following day the patient was about the same, although the tendency to develop encephalitic symptoms has disappeared. His temperature returned to normal November 2nd, the toxic symptoms subsided and no extension of paralysis appeared. By November 3rd, his general condition had greatly improved, with no apparent change in paralytic symptoms. On November 4th ultraviolet blood irradiation therapy, 150 cc. patient's blood plus 33 cc. sodium citrate was again used. His temperature rose to 99.2°F. All acute symptoms then subsided.

CASE VIII. No. 859253. T. H., a twenty-three-year old female, had grave, progressive respiratory paralysis, (complete), toxic with a temperature of 102°F. Both arms and both legs were paralyzed, she was unable to swallow, and was cyanotic even in the respirator. The patient was six months pregnant.

The diagnosis was acute bulbar and spinal poliomyelitis.

Ultraviolet blood irradiation therapy, 180 cc. of the patient's blood plus 36 cc. of sodium citrate was used November 9, 1943. The patient could not be moved from the respirator for any length of time, which necessitated that

the irradiation be given while the patient was in the respirator.

The following day the toxic symptoms were gone and her temperature was 98.6°F. The patient was able to swallow and her color was good. However, complete respiratory failure, and paralysis in both arms and legs were still present.

Thirteen days later color was again poor and definite cyanosis was present. Ultraviolet blood irradiation therapy was repeated, using 180 cc. of the patient's blood plus 36 cc. of sodium citrate. Difficulty in swallowing reappeared. Her color was improved; she rested comfortably apparently, swallowing was made easier, but no change was evident in the paralytic symptoms. By November 30th, the patient was eating well and in general was greatly improved.

While in the respirator a normal male infant was delivered at term, the first such successful delivery of a bulbar poliomyelitis mother in California.

CLINICAL OBSERVATIONS

Treatment of Sulfa Resistant Infections. The definite limitation of sulfa drugs in the treatment of infection has long been apparent to us since for over seven years we have been treating sulfa drug failures, known more euphemistically as sulfa-resistant infections. Continued work in the treatment of sulfa drug failures has greatly strengthened our original belief that sulfa sensitive infections are easily and favorably influenced by ultraviolet blood irradiation therapy and that a large variety of infections not controlled by sulfa drugs can be rapidly and efficiently controlled by ultraviolet blood irradiation therapy.

In sixty cases of sulfa drug failures ultraviolet blood irradiation therapy was found successful in controlling the acute infection in most instances. As might be expected, acute infections of apparently a virus or virus-like nature were found, when treated by sulfa drugs, to be either uninfluenced or, as occurred in a majority of cases, the infection was believed to have spread more rapidly than ever following the use of sulfa drugs. This was in sharp

contrast to the rapid subsidence of such infections when treated with ultraviolet blood irradiation therapy alone or after sulfa drug failure.

It is our carefully considered opinion that, in the treatment of most acute pyogenic infections and some virus-like infections, ultraviolet blood irradiation therapy is a far safer and much more efficient method of treatment than is chemo-therapy with sulfa drugs.

Treatment of Penicillin-Resistant Infections. In penicillin-resistant cases, we have found that ultraviolet blood irradiation therapy is a valuable therapeutic agent when used to control penicillin-resistant infections, whether of acute pyogenic type or the virus or the virus-like type.

The chief penicillin-resistant infections in which we have used ultraviolet blood irradiation therapy to control the infection have been those due to *Streptococcus hemolyticus* and colon bacillus and those of a virus or virus-like nature.

As a result of our experience in the use of ultraviolet blood irradiation therapy in penicillin resistant cases, we have been able to make the following pertinent observations:

(1) As might be expected, patients who have received penicillin without effect do not come to us as a rule with the profound toxemia that is so uniformly present in sulfa drug failures. Since no extra toxic burden has been added to the patient by the drug used, more can be expected from the use of ultraviolet blood irradiation therapy in pure penicillin resistant failures than in sulfa drug failures, provided that patient is not first seen in a hopelessly moribund state.

(2) There is no contraindication to the combination or synchronized use of penicillin with ultraviolet blood irradiation therapy, as is the case with sulfa drugs. Penicillin can be given safely before, during or immediately after ultraviolet blood irradiation therapy, since there is no photosensitization factor to be considered.

(3) Inasmuch as ultraviolet blood irradiation therapy controls certain virus or virus-like infections rapidly and efficiently and penicillin does not, ultraviolet blood irradiation therapy must be considered the procedure of choice in these infections.

(4) The rapid and favorable response of Staphylococcus septicemia to either penicillin or ultraviolet blood irradiation therapy used independently of the other, plus the lack of contraindication to a combined use of both agents, suggests that the ideal treatment for all severe staphylococcal infections is the combined treatment of the infection, using both ultraviolet blood irradiation therapy and penicillin simultaneously.

(5) Ultraviolet blood irradiation therapy by its very non-specificity has many advantages over penicillin in that it provides safe, rapid and efficient control of acute fulminating infections, regardless of whether or not such infections are due to penicillin-sensitive bacteria.

Blood Irradiation Alone in Acute Infections. (1) Ultraviolet blood irradiation therapy used alone is, in our opinion, the ideal method of controlling acute bacterial infections either of an acute pyogenic nature or of a virus-like character.

(2) It is a safe, reliable and non-specific method of controlling acute infections.

(3) It insures adequate ultraviolet intake to those whose protective immunological reactions are in the process of deterioration. This deterioration, even when progressing rapidly, has been observed to be reversed in a definite manner following ultraviolet blood irradiation therapy, resulting in consistent clinical improvement.

(4) A marked decrease in hospitalization time for such infections has been observed by us as well as other workers in the field^{5,6,7,8} following the use of this method.

(5) When blood irradiation was used in the acute infections reported here, the use of sulfa drugs or penicillin was believed to be entirely unnecessary, with the possible simultaneous use of penicillin in Staphylococcus septicemia and the absolute use of penicillin in bacterial endocarditis.

(6) The detoxification effect originally reported to occur twenty-four to forty-eight hours after the use of ultraviolet blood irradiation therapy in acute pyogenic infections was also noted after its use in virus or virus-like infections. This finding has also been recorded by Barger¹⁵ and Newman¹⁶ in acute bulbar poliomyelitis patients following ultraviolet blood irradiation therapy.

Preoperative Protective or Rebbeck Effect. Rebbeck originally described the occurrence of a powerful preoperative effect following the use of ultraviolet blood irradiation therapy before operation, i.e., uterine dilatation and curettage in cases of incomplete septic abortion.⁸ We have repeated this work in twenty-six consecutive cases and can definitely confirm this original report of Rebbeck's. We have likewise found that one may remove with impunity infected teeth and tonsils in the face of an acute rheumatic process with or without associated myocardial damage.

The tremendous potentialities for preoperative protection should be obvious to both surgeon and internist who are constantly faced with the well known dilemma of the poor surgical risk patient with dangerous foci of infection producing or aggravating the chief disease process.

It seems to us that Rebbeck's contribution to safer surgery is most important; furthermore, his preoperative protective effect has been confirmed by others besides ourselves, notably Hancock,⁵ Moser,⁶ Olney⁷ and Barrett.⁸

SUMMARY

1. The study of the clinical effects of ultraviolet blood irradiation in 445 consecutive and unselected cases of acute pyogenic infections has been made. Confirmation of our original preliminary findings was observed. These findings showed that ultraviolet blood irradiation therapy was a rapid, efficient and non-specific control of all types of acute pyogenic infections (except bacterial endocarditis), the use of which was characterized by a quick subsidence of toxic symptoms, a disappearance

of bacterial proliferation and invasion and an uneventful convalescence.

2. In seventy-four consecutive and unselected cases of virus or virus-like infections we have observed results comparable to the favorable effects observed in its use in acute pyogenic infections.

3. It was found that sulfa sensitive infections are easily and favorably influenced by ultraviolet blood irradiation therapy and that a large variety of infections not controlled by sulfa drugs can be rapidly and efficiently controlled by ultraviolet blood irradiation therapy.

4. Many penicillin-resistant infections respond favorably to ultraviolet blood irradiation therapy, both the acute pyogenic types and the virus or virus-like infections.

5. We were able to confirm the preoperative protective effect of ultraviolet blood irradiation therapy described by Rebbeck and fittingly called the Rebbeck Effect.

6. There is no contraindication to the joint use of penicillin and ultraviolet blood irradiation therapy, but sulfa drugs cannot be safely used in the first four or five days following ultraviolet blood irradiation therapy.

CONCLUSIONS

1. Ultraviolet blood irradiation therapy is in our opinion the safest and most efficient method of controlling most acute pyogenic infections with one notable exception, namely, subacute bacterial endocarditis.

2. Ultraviolet blood irradiation therapy in our opinion is the procedure of choice in the treatment of sulfa-resistant and penicillin-resistant infections of the acute pyogenic infection type.

3. Ultraviolet blood irradiation therapy is the procedure of choice in the treatment of acute infections of a virus or virus-like nature, and should be tried out universally for such infectious disease processes.

4. The preoperative use of ultraviolet blood irradiation therapy allows the safe removal of foci of infection in such serious

disease as incomplete septic abortion with or without an associated septicemia, acute rheumatic fever with or without extensive myocardial damage, acute exacerbations of chronic rheumatoid arthritis and advanced bronchial asthma.

5. It is our belief that staphylococcemias can be most effectively controlled by joint use of penicillin and ultraviolet blood irradiation therapy.

6. These results are in close agreement with those obtained by other workers in this field.⁹⁻¹⁵

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