

Staff Meeting Bulletin  
Hospitals of the » » »  
University of Minnesota

Burns

STAFF MEETING BULLETIN  
HOSPITALS OF THE . . .  
UNIVERSITY OF MINNESOTA

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Volume IX

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Published for the General Staff Meeting each week  
during the school year, October to May, inclusive.

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William A. O'Brien

I. LAST WEEK

Date: May 6, 1938

Place: Nurses' Hall  
Recreation Room

Time: 12:15 to 1:15

Program: Movie: "Tips for Lazy Husbands"

Fractures in Children  
Wallace H. Cole  
Edward T. Evans  
Stewart W. Shimonek  
Nere Sundet

Discussion: Edward T. Evans  
Leo G. Rigler  
Oscar Lipschultz  
W. T. Peyton

Present: 99

Gertrude Gunn,  
Record Librarian.

II. MOVIE

Title: "Light Waves and Their Uses"

Released by: Erpi Film Corp.

III. APOLOGIES

To Drs. Cole, Shimonek and Sundet.

To Dr. Cole because of a misunderstanding following a change in the subject for staff meeting, which prevented his attendance last week to present his departmental contribution. We regret this deeply.

To Drs. Shimonek and Sundet for unintentional omission of names from Authors' list. Both assisted in the preparation of last week's program. Thank you.

W.A.O'B.

IV. AUTHORS1. CARL LIND

Born in Minneapolis. Graduate of University of Minnesota, B.A., B.S., M.B., M.D. 1934. Internship at Receiving Hospital, Detroit, Mich. On camp service 1934-35. European travel 1935. Surgical intern at University of Minnesota Hospitals. Teaching assistant in the Department of Surgery, University of Minnesota Medical School, January 1937 to date.

2. C. BURLING ROESCH

Born in Brooklyn, N. Y. Cornell, A.B. 1934, M.D. 1937. Summer intern at Methodist Hospital, Brooklyn, 1936. Intern in Surgery University of Minnesota Hospitals, 1937-38.

3. WALLACE PARKS RITCHIE

Born in St. Paul, Minn. Attended St. Paul's School, Yale, A.B., Johns Hopkins Medical School, Internship Baltimore. Member of surgical department as fellow and assistant. We are indebted to Dr. Ritchie for this second review of the subject of burns.

V. FRIDAY, THE THIRTEENTH

Today is St. Pat's Day for the Engineers. The belated celebration has become an annual feature at this time because of weather conditions in March. The green cover on today's Bulletin is to help the good cause along. This week the citizens of Minneapolis started the first lilac drive - Share Your Lilacs With Hospital Patients. Other flowers will be welcome and lilacs will also be taken to homes for the orphans and aged. Monday, May the 23rd, there will be a dinner honoring Dr. F. E. Harrington, Health Commissioner, in recognition of 17 years of uninterrupted progress at Lymanhurst, the hospital-school for the pre-tuberculous child and lately for the sufferer with rheumatic fever. And speaking of the Health Commissioner, I imagine the dinner will cheer a little after the howls from the dog owners who object to protecting dogs against rabies and humans from the infection.

## VI. BURNS

Carl Lind  
C. Burling Roesch  
W. P. Ritchie

The Staff Meeting Bulletin, IV:14, 185-196 (Feb. 1) 1933, is devoted to the topic of Burns, and includes a résumé of 50 cases admitted from July 1, 1928 to June 30, 1932. At that time all types of cases were abstracted, including those admitted for plastic repair. Also included in the report was some of the current literature in regard to the cause, pathogenesis and treatment of burns.

Rather than repeat any of that material in the present Bulletin, an attempt is made to bring to attention any significant changes in our knowledge of burns since 1933, and also included is a résumé of 67 cases admitted from Jan. 1933 to Dec. 31, 1937. It is to be noted that only cases admitted primarily for the treatment of the burn are included in this report, and no cases are used which were admitted primarily for plastic repair which group is included in our previous analysis.

### Incidence

There has been apparently no change in the incidence. Harkins states that during the last few years deaths from burns have averaged about 6,000 per year in this country. This is about one-sixth the number dying from automobile accidents. They stand fourth among causes of accidental death, outranked by automobile fatalities, falls and drowning. Life insurance statistics show that three out of five deaths are in women and children.

### Classification

There has been no change in the classification of burns.

The three degrees of erythema, vesicle formation, eschar or slough formation, however, are often difficult to evaluate,

and, unless adequate record is kept it is impossible to determine the extent of the burn from the chart alone. In this respect it is the impression that the descriptions on the chart are more thorough than in the former analysis, although in many instances there was a good deal left to be desired.

There is no question that if an effort were made to determine the surface area involved by Berkow's method, an evaluation of burns could be more easily made. One gains the impression in the literature that the importance of this estimation is being fully recognized.

Berkow took into consideration the relative severity of burns of the anterior thorax, abdomen, genital and perineal regions and evolved the following percentages:

1. Lower extremities, including buttocks . . . . . 38%  
Foot 1/6, leg 2/6,  
thigh 3/6.
2. Trunk . . . . . 38%  
Anterior surface 20%  
Posterior " 18%
3. Upper extremities . . . . . 18%  
Hand 1/4, arm 3/4.
4. Head . . . . . 6%

For children he made some variation, the trunk being 40% instead of 38%, and the upper extremities being 16% instead of 18%.

The extent of the burn is considered of more importance than the degree. Pack arbitrarily estimates the severity of burns as follows:

1. All burns of 1st degree are fatal if 2/3 of body is involved.
2. All burns of 2nd degree are fatal if 1/2 of the body is involved.
3. All burns covering 1/3 of the body surface are extremely serious if

not fatal.

4. All burns covering 1/10th of the body surface should be considered serious. In the analysis of our cases only a few surface estimations were found on the chart and it was extremely difficult to estimate the area involved from the chart alone.

#### Pathological and Physiological Changes

As far as could be determined there have been no major contributions to the pathology of burns. The visceral lesions, such as congestion of brain and meninges, congestion of lungs with occasional thrombi, kidney damage, focal necrosis in liver and other generalized findings are still reported. The changes in the adrenal gland have always been of interest. Weiskotten, as shown in the previous Bulletin, found adrenal glands 3 to 5 times normal size. Whether this change has any effect in the course of the burn is still undecided.

As regards the physiological changes, most of the interest centers around the change in the blood constituents due to the concentration. Harkins has reviewed the literature regarding these changes extensively. All authors quoted below are cited by him in his article.

Davidson found a lowering of whole blood and plasma chlorides. He also found a hypoproteinemia with especial reduction in the amount of albumin. McIver, on the other hand, found normal plasma chloride.

Mattine reported an increase in the concentration of the blood magnesium of six rabbits burned.

Van der Hulst reported a decrease in the sedimentation rate during the first 24 hours with marked increase thereafter.

The edema fluid that leaks in to the tissues is reported to be a little higher in chlorides than plasma. The sugar and non-protein nitrogen contents are about the same and the protein content about 80% that of plasma.

The hemoconcentration has been a main point of interest for many years. The blood concentration reaches a peak several days after the burn and then rapidly subsides in a few days in the cases that recover. The high concentration has been used as an argument against transfusion, but it is apparently a safe procedure, as the donor blood is relatively dilute. The use of saline and glucose solution should be given careful consideration as it is possible that they will run through the capillary walls, making the blood more concentrated and the plasma volume lower. Acacia has been advocated to relieve this possibility. A hemoglobin of 125% is said to be a prognosis of fatal outcome. (Pack).

#### Secondary or So-Called Toxic Shock

Aside from the treatment of burns the cause of the secondary or so-called toxic shock has caused more controversy than any other phase of this problem.

The older theories of the cause of this shock being due to loss of fluid or absorption of toxic products are being challenged by two other theories, the adrenal theory and the infection theory.

As regards the adrenal theory, Freeman and associates state that this type of shock is due to an over-excretion of adrenalin, which attempts to keep the blood pressure near normal despite a lowered blood volume. This persists only so long, when the function of the adrenal collapses and shock ensues.

There are proponents, on the other hand, who state that there is an under-secretion of adrenalin. Still others feel that the cortex is the cause and as a result of hypofunction death ensues.

Concerning the loss of fluid, there seems to be good evidence that this, in part at least, is a contributing factor to secondary shock. The experiments of Blalock, Underhill and others

show a very marked loss of fluid into the tissue in experimental burns.

The toxic theory of secondary shock still holds its important place. The inability to determine what the toxic product is, is its main fault. Harkins lists 20 different products which have been presented by almost as many authors, and which have been brought forward on the etiological factor.

The bacterial theory has gained prominence since the publication of Aldrich in 1933. The fact that secondary shock often is present before infection is evident suggests that the shock is due to other factors than infection. However, there can be little doubt that infection is a contributory factor to this picture.

In review, it is probable that no one factor is alone the cause of secondary toxic shock. The toxic theory and loss of fluid theory seem to both contribute in part to this state and there is some evidence that infection is a contributory factor. The adrenal theories are, as yet, unconvincing.

### Prognosis

1. Scalds are more serious than burns due to dry heat.
2. Burns are more serious in children than adults and in women than in men.
3. The Negro has fewer visceral changes than the White, brunettes fewer than blondes.
4. Burns of abdomen have highest mortality.
5. Burns of genitalia, perineum, anterior thorax and abdomen cause symptoms far out of proportion to area involved.
6. Burns of flexor surface are more serious than burns of extension (contractures).

### Complications

Besides the usual complication of

contractures, infection, secondary anemia, loss of part, etc., the more unusual complications are:

#### 1. Curling's ulcer

Harkins reviews 94 cases in the literature of duodenal or gastric ulcer following burns. He records 28 different supposed etiological factors. He believes that they occur in almost 3.8% of cases. He states that a severe 3rd degree burn of a sloughing type is more apt to be accompanied by an ulcer and that children and females are more frequently affected. None of our cases had this complication.

#### 2. Tetanus

Has been reported rarely. Fasal reported no cases in 2,237 burns in Vienna, from 1905 to 1930, but had one case in 1932 and 1934. None of our cases developed tetanus and only 9 had serum. Tetanus antitoxin should probably be reserved for those cases which occur in barnyards or in which street contamination is very evident.

#### 3. Carcinoma

None of our cases has developed carcinoma, although in the previous report several were reported.

Treves and Pack (ref. to Harkins) reported 2% of squamous cell carcinoma in 1,091 cases, and .3% of 374 basal cell carcinomas followed burns. The average age of the scar was 32.5.

### Treatment

As far as the treatment of primary and secondary shock is concerned, there have been practically no changes. In our previous report the use of sedatives, intravenous fluids and blood transfusion was stressed. The use of blood transfusion seems to be of even more importance now than it was then. There has been a word of warning added to use of saline and glucose in that they tend to lodge in the tissues and, in so doing, withdraw blood plasma with them. The exsanguination trans-

fusion as advocated by Robertson and previously reported has evidently not been accepted by others.

### Debridement

In our previous report the opinions for and against debridement were equally divided. There still is a diversity of opinion but it is the impression that debridement, if carefully carried out so that there will be no additional trauma, is considered beneficial by most authors.

### Local Treatment

There is no question that there are more variations in treatment at the present time than there were in 1933. At that time the original tannic acid treatment, advocated by Davidson, was still the most popular of all. The more serious burns in our series were treated by that method, whereas other types of treatment were used only in burns of lesser degree. Variations in our treatment since that time have been consistent with the literature.

Although most of the changes have tended to improve the original coagulation type of treatment, methods which do not apply this principle are frequently reported - although the coagulating type of treatment is still by far the most prevalent.

### Tannic Acid

In the 1933 report it was stated that in more concentrated solutions tannic acid penetrated before a superficial coagulation had occurred and, consequently, a deep caustic action resulted. Because of this action a solution not over 5% was advocated. Since that time the usual percentage used in this country has been 5%. However, as high as 20% solutions are now advocated. Taylor (1936) points out that tannic acid may destroy any epithelial cells that may be present.

It has been shown that tannic acid is more efficacious when buffered with sodium

carbonate. Various antiseptics have been used with tannic acid.

These advances all have some merit. It is quite possible that the tannic acid treatment of burns will be used in the future only in the severe, extensive burns where loss of fluid and possible absorption of toxic bodies are complicating factors. It leaves a great deal to be desired. It is not antiseptic. It delays skin grafting. It cannot be used around the face or perineum or genitals, and it is possible to cause necrosis of an extremity because of a tight band of coagulum. In spite of these drawbacks, however, it remains the greatest advance in the treatment of burns yet brought forth.

### Tannic Acid and Silver Nitrate

Bettman in 1935 reported the use of 5% tannic acid followed by 10% AgNO<sub>3</sub>. The coagulum forms quickly and is more pliable than tannic acid, and is more antiseptic. This improvement is supplementing the use of tannic acid alone in many clinics.

### Tannic Acid Jelly

The most popular commercial preparations are Amertan (Lilly), tannic acid 5% in a jelly base with 1-5,000 merthiolate and Tanipaste (Upjohn), a 10% tannic acid in a non-greasy paste form with .5% chlorobutanol as a local anesthetic. These preparations are best used on the face and in minor burns.

### The Dyes

Aldrich suggested the use of gentian violet in 1933. A 1-3 or 4% solution is sprayed on as in tannic acid. The coagulum formed is much like that of tannic acid. In 1937 he advocated the use of acriviolet, claiming it far superior to gentian violet. It is our experience that gentian violet is not as superior to tannic as Aldrich claims and it certainly is a difficult substance to handle because of its staining qualities.

### Ferric Chloride

Ferric Chloride, first used by Slack in 1915 and subsequently published by Coan in 1935, apparently offers some improvement over tannic acid. Sprayed on as a 5% tincture it causes pain which lasts for several minutes. Its advantages according to Coan are the soft, pliable, thin coagulum which forms.

Aside from the coagulating agents, there are multiple ways in which burns are treated:

### Saline Bath Treatment

Hebra in 1861 popularized the water bath treatment of burns. This consisted in placing the patient in a tub of either ordinary water or with sodium chloride or sodium bicarbonate added to make normal saline or 4% sodium bicarbonate. At the end of 24 hours and each day thereafter all loose tissue was detached. The patient was removed to bed for the night and the wound covered by moist dressings.

In 1931 and 1932 Blair and his associates advocated a variation of this type of treatment. They advocated it mainly for deep burns. They place the patient in a saline bath for two or three hours a day. In the meantime they are kept in bed under a light cradle. They feel that this treatment results in early preparation for skin grafting and consequently a lower incidence of scars and contractures.

For areas around the face, joints, perineum and scrotum this treatment undoubtedly is an efficient one, but for those cases which are burned over large areas and in which shock, both primary and secondary, is an important factor, it is difficult to understand how this type of treatment will prevent serious loss of fluid or absorption of toxic products. It is also well known that immersion in baths is extremely weakening.

### Cod Liver Oil Treatment

Lohr advocated the use of cod liver oil in 1935. His results have been excellent. Many of them he treated in conjunction with plaster of paris casts.

Steele in 1935 and Holmes in 1937 are supporters of this type of treatment. Its use is more prevalent in Europe than here. There are many preparations advocated. Crude cod liver oil or cod liver oil ointment are most frequently used.

Several of our cases have been thus treated and the results have been excellent.

As regards the use of plaster of paris casts in conjunction with cod liver oil, it appears to be a good form of treatment, especially around joints. Several of our cases have been placed in plaster casts but the cases have been too few to evaluate.

The use of cod liver oil deserves more attention, especially in the burns of lesser extent and particularly in those of the face, scrotum, perineum and joint surfaces.

### Picric Acid

Picric acid has often been advocated, usually as a 5 to 10% hydro-alcoholic solution or a saturated aqueous solution. It is pain alleviating and antiseptic, but it is dangerous to use over large areas or in great quantities as it is toxic, and causes toxic symptoms. The usual commercial preparation used is Butecyn Picrate.

### Paraffin

Of all the other types of treatment, the use of paraffin is probably the most popular. Good results have been reported. However, the only property that it has is in its covering the injured area. It is necessarily re-applied every 24 hours and does not prevent loss of fluid or infection.

Harkins states that Willems and Kuhns listed 47 different methods of treatment in a study of 752 cases of burns. Possibly each of these methods has some value. The important fact to realize is that each case must be treated individually and that no

one treatment is adequate for all cases or even for all areas of the same burn.

The ideal treatment for the lesion itself should alleviate pain, prevent leakage of fluids, prevent infection and prevent absorption of toxic products, and leave a granulating or healed surface at an early date. This has not been obtained.

Analysis of 67 Cases of Acute Burns  
Admitted from Jan. 1, 1933 to Dec. 31,  
1937

In a previous Bulletin records of 50 cases were obtained from the hospital, from July 1, 1928 to July 1, 1932. At that time, however, cases which were admitted primarily for plastic repair were included, whereas in the present analysis the only cases used were those which were admitted primarily for the treatment of the burn itself. No plastic cases or those referred for oesophageal or roentgen reaction are included in this analysis.

Number of Cases

There are 67 cases divided as follows:

<u>Year</u>	<u>Cases Admitted</u>
1933	16
1934	15
1935	13
1936	13
1937	10
	67 Total

Age and Sex

The highest incidence is in infancy and childhood, an obvious relationship to relative helplessness and ignorance.

<u>Age</u>	<u>Sex</u>	
	<u>M</u>	<u>F</u>
1-5 25) . . . . .	10	15
( 27		
6-10 3) . . . . .	1	2
11-15 2) . . . . .	0	2
( 11		
16-20 9) . . . . .	4	5
21-30 13 . . . . .	5	8
31-40 4 . . . . .	3	1
41-50 2 . . . . .	1	1
51- 9 . . . . .	3	6
67	27	40

Cause

A. According to Age Group

1-5 (25 cases).

14 were due to hot fluids.  
12 were due to the act of the patient. These include pulling the fluid on themselves (7) such as soup, tea, coffee, syrup and falling into the fluid (5). In one case the child was placed in too hot a bath, in another a tub of hot water splashed on the child.

5 children were burned by flames (bonfire, house fire, fire-crackers, matches, celluloid container near stove.)

3 children were burned when a parent used gasoline to start a fire.

2 were burned by hot objects. A child put his head on a stove and an infant rolled into a radiator.

1 was burned by walking barefoot in warm tar.

6-10 (3 cases)

One fell into hot water containing 26 red hot plow shares, another ignited her beach pajamas playing outside near flames, a third had minor hot water bottle burns in hospital.

11-15 (2 cases)

One played with blasting powder, another threw a stick with attached wire over a power line.

16-20 (9 cases)

5 kerosene or gasoline burns - three in starting fire, one using match to see if tank empty, one pouring kerosene into lighted lamp between knees.

2 flame - one in automobile accident, other by backfire of "4-10" shot gun.

2 chemically by lye - one suicidal.

21-30 (13 cases)

4 gasoline - two used to start fire. One filled tank with match for light, another lighted a cigarette while clothes were gasoline soaked.

4 flame - entered burning house to save child, airplane crash, explosion of ether vaporizer during anesthesia, sprayed bushes with sodium chlorate - solution dried on clothes, hob nails sparked on sidewalk.

3 hot objects - 2 epileptics, one falling on stove, other on radiator. Mild hot water burn at home.

2 chemical - one mildly from surgical preparation, other moderately when put phenol on bruised genitals.

31-40 (4 cases)

One carried an open lamp to a 50 gallon gasoline drum.

One in house fire.

One by hot water bottle at home.

One unknown.

41-50 (2 cases)

One filled gasoline tank of machine near a stove. Other lighted gasoline soaked sleeve lighting a stove.

51-up (9 cases)

One started fire with kerosene, another with gasoline.

One tipped over pressure cooker while canning, another fell over a hot stove and pulled over some hot water.

One burned by exploding stove polish, another ignited "drinking alcohol" in pocket when lighting a cigarette.

One mild hot water bottle burn in hospital.

One scorched by diathermy electrode.

One iodine burn under plaster cast.

B. According to Physical Agent

<u>Agent</u>	<u>1-5</u>	<u>6-10</u>	<u>11-15</u>	<u>16-20</u>	<u>21-30</u>	<u>31-40</u>	<u>41-50</u>	<u>50 +</u>	<u>Total</u>
Kerosene and Gasoline	3	0	0	5	4	1	2	2	17
Hot Fluids	14	0	0	0	0	0	0	2	16
Fire & Explosion	5	1	1	2	4	1	0	2	16
Chemical	1	0	0	2	2	0	0	1	6
Hot Objects	2	2	0	0	3	1	0	1	9
Electricity	0	0	1	0	0	1	0	0	2
Unknown	0	0	1	0	0	0	0	0	1

The unknown cause was probably due to fire (from description).

caused by open flames near the fluid. These burns were all caused by acts of adults.

Of the youngest and largest group, 16 burns were directly due to the acts of others, the remaining 9 being caused by acts of the child or infant.

As regards hot fluids, patient was usually burned by accidentally tipping a container or falling into the container.

10 of the 17 kerosene and gasoline fires occurred in using the fluid to start a fire. The remaining 7 were

Hot water bottles accounted for 4 mild burns - two at home and two at the hospital.

Time of Year

<u>Agent</u>	<u>Month</u>											
	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sep.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>
Gasoline & Kerosene	1	1	2	2	0	2	0	5	3	0	0	1
Fire and Explosion	0	3	2	1	1	2	1	4	1	0	0	1
Hot Fluids	0	0	3	0	2	1	2	1	5	2	2	0
Hot objects	0	1	0	0	0	0	0	2	0	2	1	2
Chemicals	0	0	0	1	1	0	0	1	0	1	2	0
Electrical	0	0	0	0	1	0	0	0	0	0	1	0
	1	5	7	4	5	5	3	13	9	5	6	4

The obvious peak during the cold months is notable.

covered with sterile dressings.

Emergency Treatment

This probably depended somewhat on the severity.

The lay emergency treatment was generally of some oil (olive oil, cooking oil, motor oil, linseed oil, butter, lard, salad oil) or salves ("unguentine," vaseline, etc.). Baking soda paste was common. Vinegar was used in one case and table salt in another.

The medical emergency treatment was generally morphine if the burn was extensive, and various local applications. Protein coagulants were common (tannic acid or Amertan). One case picric acid solution. Paraffin was used once. Salve and ointments were common ("Unguentine," butecyn picrate, boric acid, zinc oxide, and mercurials). Most severe burns were cleaned somewhat and

Interval Between Burn and Admission

0	hr.	5
1-3	hr.	16
4-12	hr.	17
13-24	hr.	7
1 day-3 days		5
4 days-1 week		3
1 week-2 weeks		6
2 weeks-4 weeks		7
Unknown		1

Roughly, excluding hospital burns, one-fourth were admitted in three hours, one-half in 12 hours, two-thirds in one day.

Severity

This is most difficult to evaluate. Some records are more complete in their descriptions than others. The estimation of degree depends on the subjective

impression of the examiner and his system of classification. Infection complicates the impression, especially

in late burns. There is doubtless a large factor of error in our analysis.

<u>Degree</u>	<u>Per Cent of Burned Area</u>							<u>Total</u>
	<u>0-5%</u>	<u>6-15%</u>	<u>16-25%</u>	<u>26-35%</u>	<u>36-45%</u>	<u>46-55%</u>	<u>55+ %</u>	
1	5	0	0	0	0	0	0	5(D <sub>0</sub> )
2	8	2	4	1	1	2(D <sub>2</sub> )	0	18(D <sub>2</sub> )
3	2	1	0	0	1(D <sub>1</sub> )	0	0	4(D <sub>1</sub> )
1-2	6(D <sub>1</sub> )	4(D <sub>1</sub> )	3(D <sub>1</sub> )	2	0	2	1(D <sub>1</sub> )	18(D <sub>4</sub> )
2-3	0	7(D <sub>1</sub> )	4(D <sub>1</sub> )	2(D <sub>2</sub> )	0	0	1(D <sub>1</sub> )	14(D <sub>5</sub> )
<u>1-2-3</u>	<u>2</u>	<u>1</u>	<u>3(D<sub>1</sub>)</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>1(D<sub>1</sub>)</u>	<u>8(D<sub>2</sub>)</u>
<u>Total</u>	<u>23(D<sub>1</sub>)</u>	<u>15(D<sub>2</sub>)</u>	<u>14(D<sub>3</sub>)</u>	<u>6(D<sub>2</sub>)</u>	<u>2(D<sub>1</sub>)</u>	<u>4(D<sub>2</sub>)</u>	<u>3(D<sub>3</sub>)</u>	

Deaths in relation to the degree and percentage of burn.

4% of cases limited to		5% of the body died.	
13%	" "	" "	6-15% " " " "
21%	" "	" "	16-25% " " " "
33%	" "	" "	26-35% " " " "
50%	" "	" "	36-45% " " " "
50%	" "	" "	46-55% " " " "
100%	" "	" "	56-70% " " " "

On the other hand:

9% of cases of 1st degree died.			
11%	" "	" 2nd	" "
22%	" "	" 3rd	" "
22%	" "	" 1 and 2nd degree died.	
35%	" "	" 2 " 3rd	" "
25%	" "	" 1, 2 and 3rd degree died.	

#### Hemoglobin Determinations over 100.

108 - Recovered  
 112 - Recovered  
 131 - Recovered  
 101 - Died  
 104 - Died  
 117 - Died  
 126 - Died  
 140 - Died

against primary shock if present. Parenteral fluids and blood transfusions were employed in addition to warmth, position.

Late treatment is directed against secondary shock (toxemia?), if present, or infection. Forcing of fluids, oxygen, blood transfusion all used. Transfusion is increasing relative to time.

#### Treatment

##### A. General

Early treatment is directed

##### B. Local

Most burns were first cleansed (H<sub>2</sub>O<sub>2</sub> - saline, etc.). Blisters were sometimes opened. Most cases

here of any severity were treated with tannic acid, Amertan, or gentian violet. Burns about the face were frequently not tanned, but ointments used (vaseline, boric, etc.). Skin grafts done as soon as surfaces were clean - usually multiple graft method.

Several cases have been treated this year (since January, 1938) with cod liver oil ointment 20% in vaseline, with excellent results.

#### Q. Infection

More than one-half of the crusted burns became infected, by the usual bacteria of the skin. 31 of 67 cases were infected. Usually the crusts were removed at that time (saline soak) and saline baths or antiseptic packs applied (acriflavin, azochloramid, etc.).

- D. No ulcers or carcinoma noted in this service.
- E. During treatment physiotherapy and splints used to avoid contractures.
- F. Plastic surgery frequently required for contractures.
- G. 9 of the 67 cases were given tetanus antitoxin. No cases developed.

#### Average Hospital Days

This is very difficult to compute since one can only guess at the time at which the case ceases being treated for its burns and is treated for contracture or other deformities. Assuming a burn that is not fatal requires treatment for the burn alone for no more than 100 days, the average hospitalization is about 29 days.

In this series, 14 of the 67 patients died, a mortality of 21%. The brief histories appended will perhaps partly explain this seemingly high rate. In

order of their occurrence the fatalities were;

1. 2 Yrs., Female. In Sept. 1932 she pulled some soup from the stove, burning feet, right extremities, chest and abdomen (approximately 1/2 of body). There was primary shock. Emergency treatment consisted of vaseline and baking soda. Arriving at the hospital 3 hours later with a hemoglobin of 90%, she received 5% Tannic acid to burns, no tetanus antitoxin, and general treatment of intravenous glucose and 2 transfusions of blood totaling 500 c.c., but died 5 days later of secondary shock.
2. 4 Yrs. - Male. On July 5, 1934, patient threw firecrackers in a bonfire and the explosion ignited his clothes, burning 1/4 of body with 1st and 2nd degree burns. No shock. Emergency treatment - cooking oil. At hospital 1 hour later. Hemoglobin 90%, leucocytes 40,000. Burns cleaned with ether and sprayed with 7% Tannic acid, gentian violet to smaller areas. No tetanus antitoxin. Parenteral fluids, no blood. 3 days later child had sudden convulsions and died.
3. 18 Yrs. - Male. In December, 1934 while cleaning a gasoline tank, he lit a match to see if there was any gas left, with an explosion resulting. Face was burned and oesophagus ruptured into thorax. No primary shock. Emergency treatment - Morphine gr. 1/4. To Hospital in 6 hours where Amertan was put on face. Developed empyema and died in 11 days.
4. 53 Yrs. - Male. In January, 1935 patient with drinking alcohol in his pocket, lit match for a smoke and caught fire, burning his back, scrotum, right leg and left thigh and leg, receiving 2nd and 3rd degree burns on about 1/4 of body. He was treated with a "hypo" and salve, and came in 4 hours later. Hemoglobin 126%, erythrocytes 5,800,000, leucocytes 20,100. Primary shock. Tannic acid was put on burns.

Tetanus antitoxin was given. Infection treated with merthiolate and hot soaks. Died 20 days later from bronchopneumonia.

5. 5 Mos. - Female. Patient was left alone on a table and rolled into a radiator, remaining against it about 5 minutes, receiving 3rd degree burns, left side (face, arms, body and thighs). No primary shock or emergency treatment. Arrived at hospital in 1 hour 45 minutes. Hemoglobin 95%, leucocytes 27,550. Tannic acid spray, splints and traction constituted the local therapy. Parenteral fluids were forced. No tetanus antitoxin was given. Wounds became infected and there was secondary shock. Sepsis, otitis media and diarrhea contributed to death in 22 days.

6. 3 Yrs. - Male. In January, 1936, patient pulled a kettle of boiling water from the stove, getting 2nd and 3rd degree burns of left face, neck, flank, thigh and the entire lower back. No primary shock. Emergency treatment Tannic acid and boric ointment. Arrived at hospital in 3 hours. Hemoglobin 101%, leucocytes 27,400. No tetanus antitoxin given. Local areas treated with Tannic acid spray and Amertan. Wound infection treated with saline baths, xeroform strips and agochloramine packs. Transfusion of 300 c.c. of blood on 17th day. Hemolytic streptococcal infection with bacteremia, pyogenic arthritis of right shoulder and bilateral bronchopneumonia. Died on 20th day.

7. 1 Yr. - Male. In March, 1936, patient pulled cocoa from the stove, receiving 1st and 2nd degree burns of the chin, neck and throat. No shock. Emergency treatment "hypo". At hospital in 6 hours. Blisters opened, washed with saline and silver nitrate and Tannic acid applied. Intravenous saline. Patient died in 12 hours from edema of larynx despite laryngoscope.

8. 17 Yrs. - Female. In August, 1936, patient was burned while throwing kerosene on a fire, receiving 1st, 2nd,

and 3rd degree burns of right arm, trunk and lower thighs. No primary shock. Lesions received Tannic acid. Admitted to hospital in the 3rd week after with oliguria of 2 weeks' duration and wound infection. Hemoglobin 70%. Saline packs to wounds and later Tannic acid and silver nitrate. Intravenous hypertoxic glucose. Died rather suddenly 14 days after admission; oliguria of 4 weeks and severe infection.

9. 3 Yrs. - Male. In February, 1937, patient backed into a wash-tub of hot water, was immediately pulled out by mother and covered with starch water. There was primary shock and the 2nd degree burns of the entire back, lower abdomen, right arm and right leg (1/2 of body) were treated with "Unguentine." At Hospital in 5½ hours. Hemoglobin 104%, leucocytes 23,000. Was treated with Tannic acid, 10% silver nitrate, and 10% gentian violet. Secondary Shock. Intravenous fluids, transfusions, adrenalin and sodium chloride gr. V, q. 3 hrs. Developed hemolytic streptococcal infection with septicemia and secondary abscesses and pyogenic arthritis and died 89 days after admission, despite 4,510 c.c. of blood given as charted:

Day	Amt.	Day	Amt.
1	300	58	250
3	200	59	350
9	400	60	250
27	300	73	300
40	400	74	280
46	200	86	330
47	200	87	250
50	200		

10. 4 Mos. - Male. In November, 1937, patient was burned in a house fire getting 2nd and 3rd degree burns on 90% of body. Came to hospital in 1 hour and died a few minutes after admission, never recovering from primary shock.

11. 34 Yrs. - Female. In December, 1937, patient was burned in a house fire, receiving 1st and 2nd degree burns on 90% of body and primary shock. At hospital in 1 hour. Hemoglobin 140%, leucocytes 7,400. Received intravenous glucose and blood totaling 5,600 c.c. in 3 days.

Day	Amt.
1	2100
2	2650
3	850

Died on the third day in severe shock.

12. 27 Yrs. - Male. In December, 1937, threw gasoline in stove, burning himself, wife and children (Cases 13 and 14). Patient's face, hands, back, legs and chest were burned - 2nd and 3rd degree. At hospital after 1½ hours. Severe primary shock. Hemoglobin 117%. Leucocytes 31,300. Tannic acid to chest and face. Plaster cast on legs. Intravenous fluids, 2900 c.c. blood:

Day	Amt.
1	1200
2	600
3	600
4	500

Died on 4th day. Secondary shock.

13. 5 Yrs. - Male. As above. 1st, 2nd and 3rd degree burns over 90% of body. Intravenous glucose and 150 c.c. blood. No local treatment. Severe shock, Died in 9 hours.

14. 5 Yrs. - Female. As above. Face, hands, back, feet and neck were burned. Severe primary shock. Was put in plaster cast, given saline and blood but died in 12 hours.

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