TABLE I. Pentosenucleic Acid and Desoxypentosenucleic Acid Values for *Staphylococcus aureus* of the "L" Strain Over the Early Stages of the Growth Cycle.

Sampling time (min.)	Incr. of optical density at time of sampling	DNA/ total N	PNA/ total N	Nucleic acid N / Nucleic acid P ratio	Total nucleic acid (mg) From P values	Total nucleic acid (mg) PNA + DNA
0	—	.64	.60	1.68	.22	.15
0	—	.59	.49	1.61	.28	.15
0	—	.59	.72	2.50	.16	.14
37	.016	.51	1.02	2.05	.21	.17
40	.020	.62	1.47	1.83	.18	.20
55	.024	.69	1.04	2.45	.14	.14
55	.039	.67	.95	1.80	.21	.21
70	.024	.86	1.44	1.61	.19	.20
90	.056	.76	1.54	1.95	.22	.25
93	.036	.81	1.54	2.10	.19	.20
125	.089	.65	1.41	1.81	.22	.21
185	.089	.80	1.34	2.00	.20	.21
185	.091	.67	1.15	2.00	.22	.23

resting culture. It will be noted, however, that as growth proceeds, both the DNA and PNA concentrations increase, the latter more sharply, to a peak at 1-1½ hours of growth, after which declines take place. The values of Vendrely and Lehoult(2), related to mg of total nitrogen, are 0.625 mg PNA and 0.2 mg DNA. Their very low DNA value suggests that one extraction fails to remove all the relatively insoluble DNA.

Summary. The concentrations of pentosenucleic acid and desoxypentosenucleic acid per total nitrogen content at significant stages in the growth cycle of *Staphylococcus aureus* were determined. The concentrations were equal in resting or decay cultures, rose to a peak at 1-1½ hours of growth and thereafter declined. At peak concentrations, the PNA content was about twice that of DNA.

Received October 26, 1950. P.S.E.B.M., 1950, v75.

Effect of Plaster Cast on Tourniquet Shock.* (18339)

SIMON KOLETSKY AND GORDON E. GUSTAFSON.

From the Institute of Pathology, Western Reserve University School of Medicine, Cleveland.

Experimental tourniquet shock in rats is probably initiated by local fluid loss(1). The following study was made to determine whether shock could be delayed or prevented by applying a cast to reduce the edema. Previous reports indicate that local pressure is beneficial for both rats and dogs in tourniquet(2-4) and traumatic shock(5).

Method. This has been described previously (1). The technic results in severe shock which causes death within a few to several hours. Adult white male rats weighing about 200 to 250 g were used. Circulation in the left hind extremity was occluded for 5 hours by tightly wound rubber bands. Food and

* Aided by a grant from the Elisabeth Severance Prentiss Foundation.

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TABLE I. Survival Time (Hr).

	No.	Mean	Stand. dev.
Cast rats	25	10.5	±3.6
Control rats	19	4.5	±6.9

water were withheld for about 8 to 10 hours prior to application of tourniquet. Immediately after the tourniquet was removed, a plaster cast was placed around the extremity and carried well up on the abdomen. The cast was wrapped over gauze without exerting pressure. If applied too tightly, there is interference with circulation and the limb subsequently becomes necrotic and infected. In shock experiments where local pressure is used to prevent edema, the objectives are to preserve both the extremity and the animal. Cast rats and control rats without cast were compared as to mortality, survival time, fluid loss, hemoconcentration and serum creatine. Fluid loss was obtained by the method of bisection and the results were expressed as percentage of total body weight. Hemoconcentration was measured by hematocrit. Serum creatine was determined by a modification of the method previously described(1).

Results. Survival times are given in Table I. Cast rats lived longer than the controls, *i.e.* a mean of 10½ as compared to 4½ hours. The mean standard error of the two groups was 1.8 and the ratio of the mean difference to the mean standard error was 3.3.† Statistically, this is highly significant. However the mortality in both groups was 100%.

Table II shows fluid loss in cast and control animals at intervals up to 5 hours. The mean standard errors of the two groups were 0.35 and 0.31 at 1 hour and 3 hours respectively and the ratios of the mean difference to the mean standard error were 3.1 and 5.5 respectively. These results are of high order of statistical significance.

The effect of the cast was to diminish the rapidity of local extravasation. Cast rats required a period of 4 to 5 hours to lose as much fluid as did rats without cast in about one hour. However, at the time of death fluid loss in 21 cast rats ranged from 3.2 to 5.9% of body weight and the mean was about 4.3%. These figures are almost of the same magnitude as in non-cast rats dead in a shorter time and appear sufficient to explain the origin of shock. This in no way excludes the presence of a toxic factor. Thrombosis of vessels in the casted extremity was not observed at autopsy. Hemoconcentration occurred more rapidly in the control than in the cast rats as shown in Table III.

The rise in serum creatine was distinctly less pronounced in the cast rats (Table IV). At 3 and 5 hours respectively after removal of the tourniquet, the values in non-cast rats were 50 and 100% higher than those in the cast animals. The mean standard errors of the 2 groups at 1, 3, and 5 hours respectively were 1.7, 2.4, and 2.2. The corresponding ratios of the mean difference to the mean standard error were 4.7, 6.1, and 15.1. These are statistically significant results.

Discussion. In this study a rigid cast, applied to the extremity of a rat immediately after prolonged ischemia, did not prevent edema. The cast limited swelling of the limb and altered the direction of extravasation. Fluid was shifted upward into the fascial planes between subcutaneous tissue and oblique abdominal muscles. When the cast was removed after death, no significant swelling of the extremity was visible grossly, although there was marked internal edema of the lower abdominal wall and flank. The latter sites cannot be restricted by the cast. Such fluid loss is readily detected by the method of bisection, whereas immersion (fluid displacement) would not be accurate.

Another effect of the cast was to diminish the rapidity of local fluid loss. This may have been due in part to the resistance offered to the extravasate by the soft tissues of

† The stand. dev. was calculated by the formula $\sigma = \frac{\Sigma\chi^2}{n-1}$ where $\Sigma\chi^2$ represents the sum of the squares of the deviations from the mean and n is the number of animals. The mean stand. error was determined by the formula $\sqrt{\frac{(\sigma_1)^2}{n_1} + \frac{(\sigma_2)^2}{n_2}}$, where σ_1 and σ_2 are the stand. dev. of the cast and control rats respectively, and n_1 and n_2 the number of animals in each group. When the ratio of the mean difference to the mean stand. error is greater than 2.5, the result is significant at the 1% level.

TABLE II. Fluid Loss.

Time of sacrifice after release of tourniquet,* hr	% of body weight			
	Cast rats		Control rats	
	Mean	Stand. dev.	Mean	Stand. dev.
1	2.3	±.79	3.4	±.32
3	3.1	±.93	4.8	±.58
5	3.5	±.76		

* 12 cast and 15 control rats were sacrificed at each time interval.

TABLE III. Hemoconcentration.

Time of sacrifice after release of tourniquet,* hr	Mean incr. in hematocrit	
	Cast rats	Control rats
1	12	14
3	14	23
5	18	

* Determinations were made on 15 cast and 15 control rats at each time interval.

In this study edema developed in spite of the cast. The impression was gained that after prolonged anoxemia of a limb it is not possible to apply a rigid cast which prevents edema while still permitting normal blood flow. On the other hand Glenn, Gilbert and Drinker(7) claimed that a cast applied to the foot of dogs after a severe burn allowed

TABLE IV. Serum Creatine.

Time of sacrifice after release of tourniquet,* hr	Serum creatine			
	Cast rats		Control rats	
	Mean	Stand. dev.	Mean	Stand. dev.
1	22.1	±3.6	30.1	±5.0
3	26.2	±7.1	40.9	±3.4
5	30.2	±5.5	63.5	±3.9

* 11 cast and from 15 to 25 control rats were sacrificed at each interval. In the 3 and 5 hour controls, determinations were usually made on pooled blood from 2 or 3 animals.

the abdominal wall after further expansion of the leg was prevented. The slower rate is consistent with prolongation of survival time, even though mortality is not altered. At the time of death, fluid loss in cast rats was comparable to that in the non-casted controls. Cast rats also showed a slower rate of tissue breakdown, as measured by serum creatine, than control animals. Possibly this, as well as slower fluid loss and hemoconcentration, was related to altered circulation in the extremity after a cast was applied, *i.e.*, blood might pass through the main capillary bed without use of bypaths. Also, since elevation of serum creatine results from washing out of muscle creatine after anoxia causes irreversible hydrolysis of phosphocreatine, the slower rise might indicate reduced blood flow.

normal circulation and abolished capillary leakage.

Summary. Tourniquet shock in rats cannot be prevented by a rigid cast applied to the hind extremity immediately after removal of the tourniquet. The effect of the cast is to reduce the rapidity rather than the ultimate magnitude of local fluid loss. Survival time of the animals is prolonged but there is no decrease in mortality. The development of shock is accompanied by hemoconcentration and rise in serum creatine both of which occur more gradually than in control rats without casts.

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Received October 23, 1950. P.S.E.B.M., 1950, v75.