

THE THERAPEUTIC USES OF INTRAVENOUS PROCAINE*

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INTRODUCTION

In a recent report (1) based on one year's experience with intravenous administration of procaine hydrochloride, we reported favorably on its safety as a hospital procedure under controlled conditions. We presented a series of 448 cases, in which 1954 infusions were given in one year without morbidity or mortality. The basis of treatment was the "procaine unit,"—a formula for dosage which we have fully discussed previously (2, 3).

In the following report it is our purpose to present a detailed analysis of the types of cases in which this treatment by this method was employed and to evaluate our results.

It is beyond the scope of this paper to review the physiology and pathology of pain or the mediation of nerve impulses. Moore (4) has demonstrated experimentally that pain results when a stimulating agent is permitted to reach the capillary bed in effective strength. The histologic demonstration of sensory nerve endings in the intima of arteries or on capillary endothelium is still a matter of controversy (5, 6, 7). If it is assumed that pain endings are located in the intercellular spaces of the peripheral tissues, where they are reached by an irritant as a result of capillary permeability, then sensibility is not arterial but resides in the tissues adjoining the capillary bed (4).

It is generally accepted today that at the site of inflammation capillary dysfunction exists. Without taking into account the cellular components of the blood vessel, permeability of the capillary membrane depends on an intercellular cement and on an adsorbed layer of protein which can be affected independently or concurrently by changes in the

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fluids bathing either side of the capillary (8). Changes in hydrogen ion concentration and calcium content of the medium will vary the permeability, for the cement behaves as if it were a reversible calcium salt of a weak acid, probably a proteinate. This same cement substance is not laid down in the absence of vitamin C. In brief, the effectiveness of intravenous procaine therapy in the pathologic state is based on the permeability of the capillary membrane to colloids as well as to ions (9, 10, 11, 12, 13, 14, 15).

CLINICAL OBSERVATIONS

The 448 cases, upon which this report is based, are classified as (1) traumatic (table 1); (2) inflammatory (table 2), and (3) miscellaneous (table 3). Each table lists the types of cases, the number of cases, the total number of infusions given in each subdivision, the average number of infusions in each case, and the results.

TABLE 1
TRAUMATIC CONDITIONS

Type	No. of Cases	Total No. Infusions	Average No. Infusions	Results
1. Fractures	61	113	2	Relief of pain, decrease in edema, early mobility. Some clinical evidence of early healing. Insufficient anesthesia for reduction.
2. Post-dislocation Arthralgia	17	55	3	Relief of pain, increase in mobility. Shorter period of disability.
3. Sprains	19	24	1	Immediate relief of pain with increased mobility. No symptoms of "after pains."
4. Traumatic Arthritis	12	51	4	Relief of pain. Increase in mobility depends on pathologic changes, deformity, and duration of symptoms.
5. Myofascitis	44	175	4	Relief of pain and early mobility. More effective in low back pain. Myalgia of upper back responds better to local infiltration.
6. Herniated Intervertebral Disk	22	44	2	Useful as a differential diagnostic aid. No change in symptoms.
7. Postoperative Pain	14	45	3	Relief of pain. Better convalescent period.
8. Reflex Sympathetic Dystrophy	33	81	3	Relief of symptoms. Good results obtained in phantom-limb.
9. Laceration and Contusion	2	2	1	May be used as a substitute for general or regional anesthesia.
Total	224	590		

The criteria for the evaluation of our results are (1) the patient's statement as to the relief of pain, and (2) various signs indicative of improvement in the pathologic condition. The variability in the perception of painful stimuli in different individuals is generally accepted. The symptom complexes described by Leriche (16) and others (17, 18) are modified with the relief of pain. Increasing mobility of joints, temperature changes in the skin, diminution of cyanosis, and so forth, are among the positive findings which we accept as signs of improvement.

TRAUMATIC CONDITIONS

The results in the management of pain in trauma have been uniformly good. The relief of pain by means of intravenous administration of procaine is more easily understood when we realize that procaine given intravenously is concentrated from seven to eight times more in traumatized than in normal tissues (19). A previous report suggested that the action of procaine given intravenously was at the primary neuron of the reflex arc (20).

FRACTURES

The 61 cases of fractures represented many types, excluding compound, involving most parts of the body. Thirty patients were given procaine infusions prior to reduction with considerable relief of pain, but in only 2 cases was reduction possible under this anesthesia. Procaine intravenously is not satisfactory as an anesthetic agent. The other 31 patients were treated after reduction and all had immediate relief of pain. The infusion was repeated in some cases in order to abolish mild pain which sometimes returned. Immediately following the infusion most patients were relieved of the burning, throbbing pain at the site of fracture. Posttraumatic edema diminished within forty-eight hours, frequently necessitating application of a smaller plaster of paris casing. In Colles' and Pott's fractures early movement of the digits was voluntarily started by the patients themselves. Although many patients exhibited clinical evidence of early healing, we believe that our series is too small to warrant definite conclusions. The use of procaine intravenously after reduction will prove beneficial to the patient and gratifying to the surgeon.

One is familiar with the boggy, cold and painful ankle following a Pott's fracture involving an anticipated disability of twelve to fourteen weeks or longer which is due not so much to the failure of bony union as to soft tissue changes with mild or severe vasospasm and osteoporosis of varying degrees (21). In contrast to this the following case history is typical of the results that we have obtained with procaine given intravenously.

A 17-year-old male student sustained a spiral fracture of the left tibia and a transverse fracture of the left fibula at the junction of the lower and middle

thirds on April 6, 1947. He was admitted to the hospital on April 7, 1947, at which time there was marked swelling of the ankle and foot. His weight was 80 kg. He received 320 mg. of procaine intravenously. The relief of pain was immediate and the patient was able to move his digits without pain. A plaster of paris sugar-tong splint was applied. On the third day after admission the edema was so diminished that application of a smaller casing was required. An intravenous infusion of procaine was given prior to the reapplication of the casing and the procedure was accomplished without pain. In the fifth post-traumatic week the casing was removed, and active and passive ankle movements were made without pain. The patient was allowed to get about on crutches and was instructed not to bear weight on the injured extremity. In the seventh posttraumatic week the patient returned and informed us that he had been bearing weight without crutches for the past week. He was discharged nine weeks after sustaining the injury and was symptom-free.

POSTREDUCTION ARTHRALGIA

There were 2 cases of dislocation of the elbow and 15 cases of dislocation of the shoulder. All these dislocations were reduced under general anesthesia and the patients had severe postreduction pain and limitation of motion. The patients in whom the elbow was injured in addition, had severe swelling owing to hemorrhage. Procaine intravenously produced immediate relief of pain in all cases. Repetition of infusions was deemed necessary to diminish muscular spasm and increase mobility.

SFRAINS

The results with procaine intravenously are uniformly good. Not only are the dramatic relief of pain and early mobility produced by local infiltrations of procaine in these conditions duplicated by its use intravenously, but also this method has the advantage of eliminating the disagreeable "after pains." Most patients require only one infusion.

TRAUMATIC ARTHRITIS

In the average case 4 infusions are required one to two times weekly for relief of pain. The increase in mobility varied, since it depends on pathologic changes, deformity of structures and the length of time the disability has existed. The following case report is presented.

A salesman, 52 years old, sustained a fracture of the surgical neck of the right humerus seven and a half years ago. His recovery was uneventful except for the fact that he had pain with changes in the weather and partial loss of function of the shoulder. Roentgenologic examination revealed peri-arthritis of the shoulder. The ability to put his hand behind his back was limited to the region of the right hip. His weight was 80 kg. and 320 mg. of procaine and 320 mg. of vitamin C were given intravenously in twenty minutes. Immediately following the infusion, the patient was able to put his right hand behind his back and touch the opposite scapula. A second infusion was given two

weeks later for mild pain. It is now two months since the initial treatment and there has been no recurrence of pain or loss of mobility.

MYOFASCITIS

This group of 44 cases included 8 cases of myalgia in the region of the scapula and shoulder girdle. None of these 8 patients responded to procaine intravenously as well as did the 36 patients with low back pain. Local infiltration of trigger points gave better results. Patients who had low back pain responded satisfactorily in that they were able to get about immediately after the first infusion. The relief of pain may last only twenty-four to forty-eight hours, but when it returns it is much less severe. The average patient required 4 infusions, each infusion given on the return of pain.

HERNIATED INTERVERTEBRAL DISK

All of the cases in this series were found at operation to have rupture of the intervertebral disk. Intravenous administration of procaine does not relieve the pain or the spasm in this condition. Each patient was given 2 infusions in order to evaluate any response. This procedure is being used as a differential diagnostic aid in low back pain.

POSTOPERATIVE PAIN

The results in this category do not differ from the observations of other investigators (22, 23). Although in some of our cases procaine replaced morphine, its greatest benefit was in establishing a more comfortable postoperative convalescence.

REFLEX SYMPATHETIC DYSTROPHY

The symptom-complex of reflex sympathetic dystrophy has always been a challenge to the surgeon. The effect of procaine intravenously in these cases is dramatic. In this classification we have included 4 cases of phantom limb. The action of procaine given intravenously is at the primary or peripheral neuron.

A 53-year-old man had had the left arm amputated at the upper third of the shaft of the humerus following a crushing compound fracture several years ago. He suffered "spasms of the fingers" with his "nails boring into the palm." Prefrontal leukotomy was considered for the relief of pain. Immediately following the first procaine infusion, the patient stated that "the hand was relaxed." A total of 6 infusions was given two times weekly. Six months since the last infusion the patient returned because of slight pain and "spasm." Another infusion of procaine gave him relief.

LACERATION AND CONTUSION

In these 2 cases intravenous administration of procaine was attempted early in our investigation to determine the efficacy of this

TABLE 2
INFLAMMATORY CONDITIONS

Type	No. of Cases	Total No. In-fusions	Average No. In-fusions	Results
1. Rheumatoid Arthritis	13	182	14	Relief of pain, increased mobility, decrease in flexion contractures. Intensive therapy in conjunction with vitamin C is indicated.
2. Osteoarthritis	91	483	5	Relief of pain and increased mobility. Vitamin C therapy is indicated in many cases.
3. Neuritides	40	143	3	Of no value in tic douloureux. Relieves burning pain in herpes. Marked relief of pain in neuritis.
4. Vascular Diseases				
Coronary Disease	2	15	7	Relief of pain in angina of effort.
Thrombo-angiitis Obliterans	5	15	3	Temporary transient relief of pain.
Arteriosclerotic Gangrene	1	1	1	Used preoperatively for relief of pain.
Trench Foot	1	2	2	Improved circulation, skin temperature. Relief of pain on walking.
Diabetic Gangrene	1	12	12	In incipient cases may prevent gangrene. Relief of pain is found.
Postcerebral Accident	1	10	10	Increases mobility and coordination.
Arterial Spasm associated with Embolus	2	9	4	Prognostic aid; helps overcome shock and arterial spasm.
Chronic Lymphedema	2	15	7	Equivocal results.
Thrombophlebitis	13	52	4	Relief of pain, spasm, erythema and edema.
5. Bursitis	18	85	5	Relief of pain. Early mobility noted.
6. Tuberculous Spine	1	2	2	No change in symptoms.
7. Dermatitis	3	19	6	Temporary transient relief of pain and itching
Total	194	1045		

method in the event general anesthesia was contraindicated or regional anesthesia not feasible. Repair of the lacerations was accomplished without pain.

INFLAMMATORY CONDITIONS

Table 2 lists the inflammatory cases in a manner similar to table 1.

RHEUMATOID ARTHRITIS

In a preliminary report (24) we stated that we found equivocal results in 4 cases. Since that time we have added 9 more cases to our

series, making a total of 13. Of the 13 patients, 10 have benefited by relief of pain and increased mobility. Intensive therapy produces gratifying results. Daily infusions of procaine and vitamin C, supplemented by parenteral intramuscular injections of 500 mg. of vitamin C, for two weeks, have produced sufficient relief of pain and spasm to allow physical therapy to be instituted. The rehabilitation of the patient is of utmost importance. Relief of pain decreases muscular spasm, thus improving the flexion contractures so frequently found. The following case is illustrative of our management:

A 42-year-old housewife had been suffering from rheumatoid arthritis for the past seven years. She was bedridden for more than three years. All the joints of the extremities were involved and flexion contractures of the elbows and hands were so involved that she was unable to feed herself. Both knees were flexed and fixed at a 90 degree angle. Adductor spasm at the hips was moderate in degree. Any type of passive movement elicited pain. All laboratory examinations were indicative of rheumatoid arthritis. The blood level of vitamin C was far below the normal. She had received gold therapy and vaccine therapy one year before her admission on March 25, 1947.

For two weeks 240 mg. of procaine and 240 mg. of vitamin C intravenously were given daily, supplemented by 500 mg. of vitamin C intramuscularly. By the third day the patient felt decrease in pain, and exhibited increased mobility to the extent of being able to raise her right arm and hand to her mouth and to extend her legs slightly. At the end of one week traction was applied to both lower extremities to produce extension of the knees. Physical therapy was started at the end of the second week.

At the end of one month the patient was able to sit up in bed by herself, comb her hair, feed herself and write a letter.

At the end of the second month, there was complete extension of the knees, but the marked atrophy of the muscles necessitated the application of braces to the extremities.

At the end of the third month the patient was discharged from the hospital, able to walk with the aid of braces and crutches. At the present time she walks with the aid of her braces at least one hour a day. There is very little residual pain at present.

OSTEOARTHRITIS

The good results obtained in the treatment of this condition have been reported by us previously (24). Relief of pain and increased mobility are noted soon after the first infusion. The average case requires 5 infusions given three to four days apart. The addition of vitamin C to the procaine infusion is indicated.

NEURITIDES

Of the 40 cases listed, 7 were tic douloureux, 8 herpes, and 25 neuritis. The results in tic douloureux were poor. Only in one case was partial relief obtained. Patients with herpes zoster and facialis responded

fairly well. The burning pain is controlled by intravenous procaine. Repetition of infusion depends on the return of symptoms. In the average case of neuritis—brachial, intercostal or sciatic—the patient responds well. The treatment is similar to that for herpes.

VASCULAR DISEASES

This group is too small a series for proper evaluation. The 2 patients with coronary occlusion associated with angina of effort were relieved sufficiently by weekly infusions of procaine to allow them to walk for distances up to a half mile without distress.

In the 5 cases of thrombo-angiitis obliterans, the relief of pain was only temporary—four to six hours. We have been unable to duplicate the results of Hazard (25) or of Leriche (26), who advocated the intra-arterial approach. Despite these discouraging results, we believe that perhaps more intensive therapy may produce satisfactory results.

The one patient who had arteriosclerotic gangrene was given an intravenous procaine infusion the day before amputation. The important result in this case was the relief of pain.

Only one case of trench foot has been observed by us. There was relief of pain, paresthesia and cyanosis, and the return toward normal of the skin temperature of the affected extremity.

The one patient with incipient diabetic gangrene exhibited reddened, painful toes. The patient was admitted for probable supracondylar amputation. Intensive intravenous therapy with procaine not only relieved the pain but also reduced the edema and erythema. It is now three months since the patient was discharged from the hospital, and she has returned to work.

The course in our one case of postcerebral hemorrhage would suggest this form of therapy for rehabilitation. During the infusions, improved coordination of mouth, lips and extremities was noted. The improvement gained was not lost.

The 2 patients with arterial spasm associated with embolus were markedly improved by intravenous procaine infusions. These patients were taken from a state of shock and put in condition suitable for operation. Postoperative infusions prevented secondary spasm. Leriche (27) considered this form of treatment of prognostic value in the treatment of large emboli of the pulmonary artery.

Our 2 cases of chronic lymphedema had equivocal results by this treatment. Perhaps a larger series will help evaluate the usefulness of this therapy in this type of condition.

The effectiveness of procaine intravenously in thrombophlebitis is gratifying. Although the relief of pain following the initial infusion may last only a few hours, the pain that does return is markedly diminished. Daily infusions for three to five days reduced the pain and clinically decreased the edema and inflammation.

Of the 18 cases of acute and chronic subdeltoid bursitis, only 2 patients did not respond to this form of therapy. Daily infusions for four to five days usually gave sufficient relief of pain and increased mobility to allow the patient to get about.

As was anticipated, the results in tuberculosis of the spine were poor. No relief of pain was obtained.

The patients with dermatitis obtained relief for only a transient period.

MISCELLANEOUS CONDITIONS

Malignancy.—Intravenous procaine infusion produced temporary relief of pain for two to four hours. It was used as a substitute for morphine. The pain that returns is not diminished as in inflammatory conditions.

Posterior Poliomyelitis.—In this group 2 patients had residual vasomotor disturbances and 2 had spasticity of the affected extremities.

TABLE 3
MISCELLANEOUS CONDITIONS

Type	No. of Cases	Total No. In-fusions	Average No. In-fusions	Results
1. Malignancy	4	17	4	Temporary transient relief of pain. May be used as a substitute for morphine.
2. Posterior Poliomyelitis	4	24	6	Relief of vasomotor disturbances. Improved coordination in spastic types.
3. Congenital Spastics	8	200	25	Improved coordination, relaxation, diminution in spasm. Upper extremity spastics do not respond as well as lower extremity spastics.
4. Paralysis Agitans	4	32	8	Improvement in coordination, diminution in rapidity and amplitude of tremors.
5. Multiple Sclerosis	2	18	9	Of no apparent value.
6. Amyotrophic Lateral Sclerosis	1	10	10	Of no apparent value.
7. Scleroderma	1	7	7	Relief of pain for three months.
8. Pruritus—Hodgkin's Disease	1	11	11	Relief of itching—transient and temporary.
9. Postoperative Anuria	2	3	1	Diuresis begins almost immediately.
10. Serum Sickness	3	5	1	Relief of itching and urticaria
Total	30	319		

Improvement was noted in both subgroupings. The results were improved circulation with the absence of sensation of coldness, relief of spasm, increased mobility and improved muscular control. Two infusions weekly in conjunction with physical therapy are recommended for the management of these chronic conditions. From our observations, the alleviation of muscle spasm by the use of procaine intravenously suggests its therapeutic application for the symptom relief of the distress of acute anterior poliomyelitis.

Congenital Spastics.—The results in the above mentioned cases of anterior poliomyelitis prompted us to apply this form of treatment to congenital spastics. All of our 8 patients had been treated previously with curare in conjunction with physical therapy, with only slight improvement and relaxation of spasticity. Infusions of procaine intravenously were given daily for three to four weeks, followed by weekly infusions. All patients were given physical therapy simultaneously. Marked relaxation, increased coordination and marked mobility and use of the extremities were noted. Manipulation and stretching during the infusion produced minimal discomfort. Patients with spastic upper extremities responded more slowly than those with spastic lower extremities. An interesting side effect in these cases was improvement of speech and increase in mental acuity.

Paralysis Agitans.—Two signs of the triad of parkinsonian syndrome are tremor and rigidity associated with bradykinesia. The similarity in signs between this condition and congenital spasticity prompted us to evaluate the intravenous use of procaine for this disease. Decrease in tremors and improved coordination were noted. Although one patient in our series has remained improved for three months since the last infusion of a series of 6 in three weeks, we recommend weekly infusions for two to three months. Further infusions are to be given upon the return of symptoms.

Amyotrophic Lateral Sclerosis and Multiple Sclerosis.—No changes in the course of these diseases have been noted.

Scleroderma.—Our one patient has had relief of intense pain and increased mobility by this method. She received an infusion daily for one week. Some pain returned at the end of three months which was controlled by a similar series of infusions.

Pruritus—Hodgkin's Disease.—The relief of itching, although temporary—eight to twelve hours—offered this patient the ability to rest and sleep. The improvement in her general condition allowed her to undergo specific therapy.

Serum Sickness. Two of our cases resulted from tetanus antitoxin and one from penicillin. Our observations did not differ from those of other investigators (28, 29).

Postoperative Anuria.—These 2 patients responded excellently to this form of treatment. Langeron (30) believed that the diuretic action of procaine intravenously is probably on the vasomotor mechanism.

DISCUSSION

For the purpose of rational treatment, it is necessary to determine not only where pain originates but also the underlying pathologic condition by which pain is produced. Although the present knowledge of the action of procaine given intravenously is far from complete, its mechanism of action in damaged tissues has been suggested. Sufficient data are now known to warrant its increasing use in practice. That which gives intravenous procaine a special, constantly increasing place in therapeutics is the aggregate of actions that it can exert simultaneously: analgesic, sympatholytic and vasodilating; secondarily, parasympathetic and anticontracting (25).

The importance of vitamin C therapy cannot be overemphasized. Richards (31) suggested the administration of vitamin C prior to the use of large doses of procaine to increase resistance to toxic side effects, particularly in patients in a poor nutritional condition. Kovacs (32) recommended the addition of 1 Gm. of vitamin C, as sodium ascorbate, to each liter of 0.1 per cent solution of procaine because most arthritides show, by laboratory methods, a vitamin C deficiency.

There is evidence that interference with the reflex arc which is established following trauma will hasten the recovery and rehabilitation of the injured individual.

Of the various methods of treatment which have been proposed and tried in arthritis, intravenous administration of procaine, in conjunction with vitamin C, provides more persistent good results and relieves the physician and surgeon of trying methods of major proportions and of doubtful value, especially in destructive arthritis of the hip. Since we believe that too few patients have been treated with procaine intravenously for final evaluation, however, this method must still be considered in the investigative stage.

The improvement noted in spastic conditions of neurologic origin recommends this form of therapy for further clinical study. Although the relaxation of muscle spasm found with curare may approach that with procaine, we believe that the results obtained with procaine are superior. The relationship structurally between procaine and choline impresses us to conjecture that the improvement in these cases depends on the reestablishment of the humoral balance in the nervous system.

SUMMARY AND CONCLUSION

The results in the management of 448 cases in which 1954 intravenous procaine infusions were given have been evaluated.

The therapeutic value of the intravenous administration of procaine in selected traumatic, inflammatory and spastic conditions has been discussed.

Procaine intravenously should be considered as an adjuvant in the treatment of selected traumatic, inflammatory and spastic conditions.

REFERENCES

1. Graubard, D. J.; Robertazzi, R. W., and Peterson, M. C.: One Year's Experience with Intravenous Procaine, *Anesth. & Analg.* 27: 222 (July-Aug.) 1948.
2. Graubard, D. J.; Robertazzi, R. W., and Peterson, M. C.: Microdetermination of Blood Levels of Procaine Hydrochloride after Intravenous Injection, *Anesthesiology* 8: 236-240 (May) 1947.
3. Graubard, D. J.; Robertazzi, R. W., and Peterson, M. C.: Intravenous Procaine: A Preliminary Report, *N. Y. S. J. of M.* 47: 2187, 1947.
4. Moore, R. M.: Some Experimental Observations Relating to Visceral Pain, *Surgery* 3: 534, 1938.
5. Krogh, A.: *The Anatomy and Physiology of Capillaries*, New Haven, 1922.
6. Stochr, P.: Mikroskopische Beitrag zur Innervation der Blut Kapillaren beim Menschen, *Zbchr. f. Zellforsch. u. Mikr. Anat.* 3: 431, 1926.
7. Kuntz, A.: *The Autonomic Nervous System*, Philadelphia, Lea & Febiger, 1945.
8. Zweifach, B. W.: The Structural Basis of Permeability and Other Functions of Blood Capillaries. Cold Spring Harbor Symposia, *Quart. Biol.* 8: 216, 1940.
8. Allen, F. M.: Physical and Toxic Factors in Shock, *Arch. Surg.* 38: 155, 1939.
10. Nitzky, M. G., and Leiter, S. S.: Capillary Permeability to Horse Proteins in Burns Shock, *Am. J. Physiol.* 140: 1, 1943.
11. Fine, J., and Seligman, A. M.: Traumatic Shock: An Experimental Study Including Evidence Against the Capillary Leakage Hypothesis, *Ann. Surg.* 118: 238, 1943.
12. Allen, F. M.: Theory and Therapy of Shock, *Am. J. Surg.* 60: 335, 1943.
13. Allen, F. M.: Theory and Therapy of Shock, *Am. J. Surg.* 62: 80, 1943.
14. Cope, O., and Moore, F. D.: A Study of Capillary Permeability in Experimental Burns and Burn Shock Using Radioactive Dyes in Blood and Lymph. *J. Clin. Investigation* 23: 241, 1944.
15. Fine, J., and Seligman, A. M.: Traumatic Shock: VII: A Study of the Problem of the Lost Plasma in Hemorrhagic Tourniquet and Burn Shock by the use of Radioactive Iodo Plasma Protein. *J. Clin. Investigation* 23: 720, 1944.
16. Leriche, R.: *The Surgery of Pain*, Translated and Edited by Archibald Young, Baltimore, The Williams and Wilkins Co., 1939.
17. Livingston, W. K.: *Pain Mechanisms*, New York, The Macmillan Co., 1943.
18. Doupe, J.; Cullen, C. M., and Chance, G. O.: Post Traumatic Pain and the Causal Syndrome, *J. Neur. Neurosurg. & Psychiat.* 7: 33, 1944.
19. Musicant, B.: Personal Communication.
20. Graubard, D. J., and Ritter, H. H.: Intravenous Procaine in the Treatment of Trauma: A Preliminary Study, *Am. J. of Surg.* 74: 765, 1947.
21. Tyson, M. D., and Gaynor, J. S.: Interruption of the Sympathetic Nervous System in Relation to Trauma, *Surgery* 19: 167, 1946.
22. Kraft, K. A.: Intravenous Procaine, *Canadian M. A. J.* 57: 350 (Oct.) 1947.
23. Barbour, C. M., and Tovell, R. M.: Experiences with Procaine Intravenously, *Anesthesiology*, 9: 514-523 (Sept.) 1948.
24. Graubard, D. J.; Kovacs, J.; Robertazzi, R. W., and Peterson, M. C.: The Management of Arthritis by Means of Intravenous Procaine: A Preliminary Report. Read at the Annual Meeting of the New York Rheumatism Association, New York, N. Y., April 19, 1947 (To be published).
25. Hazard, R.: Present Status of the Physiologic Actions of Novocain and Its Therapeutic Applications, *Progres med.* 73: 403 (Dec. 10) 1945.
26. Leriche, R.: Intra-arterial and Intravenous Injection of Novocain as a General Method of Vasodilatation Caused by Action on the Endothelium, *Progres med.* 70: 443 (Nov. 10) 1942.
27. Leriche, R.: Prognosis and Treatment of Large Emboli of the Pulmonary Artery, *Lyon Chir.* 41: 257 (May-June) 1946.
28. State, D., and Wangenstein, O. H.: Procaine Intravenously in Treatment of Delayed Serum Sickness, *J. A. M. A.* 130: 990, 1946.

29. Applebaum, E.; Abraham, A., and Sinton, W.: A Case of Serum Sickness Treated with Procaine Intravenously, *J. A. M. A.* 131: 1274, 1946.
30. Langeron, L.: Utilization of Scurocaine Intravenously in Nephropathies; Its Diuretic Action Probably on the Vasomotor Mechanism, *Bull. et mem. Soc. med. d. hôp. de Paris* 60: 13 (Jan. 14) 1944.
31. Richards, R. K.: Effects of Vitamin C Deficiency and Starvation Upon the Toxicity of Procaine, *Anesth. & Analg.* 26: 22 (Jan.-Feb.) 1947.
32. Kovacs, J.: Personal Communication.

JOINT MEETING OF THE AMERICAN SOCIETY OF
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APRIL 7, 8 AND 9, 1949, STATLER HOTEL, WASHINGTON, D. C.

PROGRAM

THURSDAY, APRIL 7

Presiding: L. H. Mousel, M.D.

- 8:00 A.M. Registration.
- 9:00 A.M. A Message from the President—A.S.A.
H. Boyd Stewart, M.D., Tulsa, Oklahoma.
- 9:40 A.M. A Proposed Plan for Postgraduate Training in An-
esthesiology.
Robert D. Dripps, M.D., Philadelphia, Penna.
- 10:20 A.M. Recess to visit exhibits.
- 11:00 A.M. The Effects of Anesthesia on the Urinary Bladder.
John F. Morris, M.D., Huntington, W. Virginia.

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