rapidly established under the influence of agents which are in a way solvents of such bodies. One of the most interesting thoughts with regard to these observations is the suggestion that the solubility of some of these constituents of cells appears to be much greater during life than postmortem; the abstraction of these agents by known bodies in which they are soluble would seem to be accomplished less rapidly and less effectively from the excised or dead organ than occurs by circulating through the structures media containing anæsthetics or other substances which are solvents for the lipoids. This might be interpreted as indicating that the change was partly metabolic and not purely chemical. If the stage which is now considered dependent upon excitability after the administration of an anæsthetic is really due to the abstraction of pressor substances from the adrenals or other structures then a new point of view is obtained.

ANNUAL ORATION.

Dr. Astley P. C. Ashhurst delivered the Annual Oration entitled "The Patience of Surgery."

STATED MEETING, HELD OCTOBER 3, 1910

The President, Dr. Robert G. Le Conte, in the Chair.

OSTEOMYELITIS OF THE SACRO-ILIAC ARTICULATION.

Dr. James K. Young reported the history of a youth, aged 17 years, with good family history and without pulmonary or other inherited disease, who was admitted to the service of Dr. David Riesman at the Philadelphia Polyclinic, with the statement that the day after Christmas he fell while playing and injured his hip; two weeks later he had another fall, injuring his left hip, and five days previous to admission he had another fall from a wagon. Upon admission he complained of pain in the region of the left hip, and there were tenderness, heat, and deep fluctuation in this area. The leg could be moved without much difficulty. His condition not improving and a leucocyte count of 14,600 being found, the sacro-iliac joint was exposed, a portion of the ilium was removed, and the hip-joint was exposed, but no pus was found. Within six hours, however, suppuration became profuse and continued for several days. The cultures showed *Staphylococcus aureus*. His recovery was interrupted by an attack of orchitis. The case is reported on account of the rarity of acute suppurative conditions of this articulation and their recovery under treatment.

EARLY (TREVES) OPERATION FOR PSOAS ABSCESS.

Dr. Young also reported the history of a boy, aged seven years, family history negative for tuberculosis or other inherited disease, who, two days before admission to the Polyclinic Hospital, began to bend forward on the right side and to complain of pain in the right hip, with night-cries. Upon admission the right thigh was flexed, the movements of the right hip-joint were otherwise normal. There was tenderness in the right lumbar region with rigidity of the spine, but without any fulness in the iliac region. The osseous lesion of the spine was revealed by an X-ray, and the diagnosis of psoas abscess was made. The

abscess was opened by posterior dissection after the method of Treves, six days after admission. In three days the temperature was normal and in twelve days from time of operation the wound was healed and the patient was discharged from the hospital wearing a fixation apparatus.

SACRAL LAMINECTOMY FOR TUBERCULAR MONOPLEGIA.

Dr. Young also reported the history of a man, aged 38 years, who was admitted to the Polyclinic Hospital under the service of Dr. David Riesman suffering from an atrophy and pressure palsy of the left leg. He stated that several years before he had been injured by a horse. There was prominence of the spinous processes of the sacrum, with tenderness over this region. A laminectomy was performed, removing the second and third laminæ and exposing the nerves. An examination of this bone showed the presence of bony tuberculosis. The wound was an oval flap incision with the convexity upward in order to diminish infection, and primary union was secured. The operation removed the pain in this region, but pain in the lower extremity was not entirely relieved.

LACERATION OF THE AXILLARY PORTION OF THE CAPSULE OF THE SHOULDER-JOINT AS A FACTOR IN THE ETIOLOGY OF TRAUMATIC COMBINED PARALYSIS OF THE UPPER EXTREMITY.

BY T. TURNER THOMAS, M.D.,
OF PHILADELPHIA.

We are all more or less familiar with those cases in which the upper extremity becomes partially powerless, the muscles, especially those about the shoulder, atrophied, and the shoulder and arm stiff and painful, from a trauma of the shoulder region. Among the neurologists, in particular, the tendency has been to ascribe them to a lesion of the brachial plexus, as in Erb's palsy, in which the trauma is localized to a point above the clavicle, where the nerve-fibres to the muscles usually found involved are grouped together (Erb's point). In the cases which I have in mind, scapulohumeral limitation of movement is associated, on account of which, I believe, many of them have been ascribed by surgeons, in particular, to inflammation in the subacromial or subdeltoid bursa. I have stated in detail elsewhere [1] that I do not believe they are best explained by the bursitis theory, which does not account for the loss of power, and the supporters of which admit that they have difficulty in explaining the pain frequently radiating down the arm. Codman [2] says that in some cases these secondary changes in the nerves and muscles almost amount to a real paralysis and simulate lesions of the brachial plexus or progressive muscular atrophy. Nerves may be ruptured but I believe that in most cases they are not. The basic lesion, in my opinion, is a more or less extensive laceration of the axillary portion of the capsule of the shoulder-joint, the lesion of an anterior dislocation of the shoulder.[1] The essential cause of the dislocation is forced abduction of the arm, the most free and least restricted move-

ment in this joint, and the movement most frequently exposed to severe violence and to the leverage of a fully extended and rigid upper extremity, as in falls on the hand. The chief resistance at the shoulder to movement beyond the physiological limit due to forced abduction is from the axillary portion of the capsule, which frequently tears in consequence. Often from such a force an anterior dislocation of the shoulder results, in many of which, as the arm immediately afterwards drops to the side of the body, spontaneous reduction takes place and the fact of the occurrence of the dislocation is never recognized. In probably a great many more, the tear in the capsule is not sufficient to permit a dislocation, and it then represents the lesion of a sprain, a condition which at the present time is practically never recognized as such. The lesion is deep seated and difficult to locate by the ordinary signs of a sprain. The patient does not recall that forced abduction was a factor in the causation of the symptoms, because of the excitement of the moment, and because immediately afterward the arm fell to the side of the body into the position of rest, of most complete relaxation of the torn portion of capsule and therefore of least pain, where he finds it when he begins to take account of what has happened.

Internal rotation further relaxes the injured portion of capsule, so that the patient soon learns to keep the forearm in front of the chest in the sling position. Abduction and external rotation, especially the former, drag upon the seat of trouble and are avoided so long, that when the pain subsides and the patient wishes to use the limb, he finds that he cannot move it far from the side, the torn portion of capsule having become contracted in its relaxed condition. The loss of power and the atrophy of the muscles of the shoulder and arm are due primarily, I believe, to the involvement of the nerves in the axilla by perineuritis and neuritis from the inflammatory conditions in the axilla, which are secondary to the lesions in and about the joint. The atrophy and loss of power are probably in part due to the resulting scapulohumeral limitation of movement, and I have thought that it was in part due to the limitation of movement per se, *i.e.*, that there resulted a certain

loss of balance in the functions of the muscles of the extremity because some of those at the shoulder were thrown out of action by the shortened capsule. This was suggested by an observation in one case, in which a considerable impairment of the movements of the hand disappeared on the day on which the scapulohumeral limitation of movement was broken under an anæsthetic and the arm dressed in full abduction. The patient was delighted to find that so quickly all of the movements and much of the power had returned to this hand. Nothing else had been done than to tear the shortened capsule that could explain the return of power in the hand, so that I could see no other explanation than that the scapulohumeral ankylosis alone had been in some way responsible for the weakened movements in the hand and perhaps for some of that in the forearm and arm.

I am not prepared to enter into a detailed discussion of an intricate and confused neurological question, but I have been impressed with an apparent similarity between these stiff and painful shoulders and some of those which are called, by the neurologists in particular, traumatic brachial paralyses; and I wish to offer a few facts which tend to show why they are often confused with each other. The surgeon is usually impressed most by the disturbances in the shoulder-joint, the neurologist by the loss of power in the muscles. The latter rarely takes into account the scapulohumeral ankylosis, occasionally referring to it vaguely as secondary to the condition of the nerves and muscles, that is, to contractures of muscles and ligaments.

Schulz [3] made an interesting study of the late results in cases of dislocation of the shoulder which appeared in Küttner's clinic at Breslau during a period of five years. There were 160 cases, but a large number failed to return for re-examination, and some of the remainder were excluded because of the complications which existed. The late results in 54 uncomplicated (by any fracture, according to the X-ray, by myositis ossificans, or nerve paralysis) traumatic dislocations did not justify the prevailing tendency to give a favorable prognosis after reduction of a dislocation of the shoulder.

In only seven cases (13 per cent.) were there no disturbances of motion in the arm, no noteworthy diminution of strength, and no pain in bad weather. In 14 cases (26 per cent.) the movement was free, but the power in the arm was reduced at least a third, in most a half, and in one two-thirds. In 39 cases (75 per cent.) there was weakness in the arm, and in about a half of these there was more or less continual pain in the shoulder, which was so much worse in bad weather that it became necessary to suspend work. In many cases movements absolutely necessary for many occupations could not be performed at all or only to a slight extent. Schulz says that the chief cause of these poor results is to be sought in the cicatricial contraction of the joint capsule and surrounding tissues.

Delbet[4] and Cauchoix in a recent study account for what seems to me to be very much the same type of disturbances following dislocations of the shoulder, by assuming the existence of injuries to the nerves. They say that at first it was universally admitted that these nerve lesions were due to the wounding of the terminal trunks of the brachial plexus by the luxated humeral head, but that at the present time this conception is much combated, because the muscle groups paralyzed correspond not to the territory of innervation of a nerve but to that of a root. They consider it unnecessary to dispute all the theories which have been offered to explain how these paralyses are produced. It appears to me that we have, in these various theories referred to, an indication of the obscurity of the etiology of the loss of power frequently associated with dislocations of the shoulder. Delbet and Cauchoix consider that most authorities at the present time accept the theory of a radicular paralysis in most of the cases due to a trauma about the shoulder; and they divide the cases into those due to lesions of the roots of the plexus or radicular paralyses, those due to lesions of the plexus itself, and those due to lesions of the terminal branches of the plexus. The chief object of their work was to encourage early operation. In three cases they exposed the nerves in the axilla and freed them of adhesions. When the plexus or its roots are the seat of the lesion they

advise a similar operation above the clavicle. Vandenbossche,[5] in discussing traumatic radicular paralyses due to injuries about the shoulder, says that because of the multiplicity of the nerve lesions, their association with truncular lesions, and the fugaciousness of certain symptoms, the diagnosis of these paralyses is difficult to make, except at the beginning. He also favors operation in grave cases.

That the radicular and plexus lesions are considered as frequently being due to injuries of the shoulders other than dislocations is attested by the already extensive literature on the subject. Underlying all this discussion and confusion, and in my opinion accounting for it, is the difficulty in locating a nerve lesion, which can explain the great variety of the nerve manifestations presenting themselves in these cases. Originally, as stated by Delbet and Cauchoix, the tendency was to locate the lesion in the axilla, that is, that it was due to the trauma produced by the dislocated humeral head. This became untenable, because the distribution of the nervous disturbances was too extensive and varied to be accounted for by such isolated nerve lesions as could be expected from such a cause. In the search for a higher nerve lesion, the condition of the joint is generally ignored. I suspect that scapulohumeral limitation of movement is nearly always present in these cases diagnosed as traumatic brachial paralyses, and if the various nerve symptoms which occur could be accounted for on the basis of the conditions existing in the axilla, a long step would be taken in the direction of clearing up the pathology. I have already shown that a sprain of the shoulder is probably common to those cases due to a wide variety of accidents to the shoulder region, and I have pointed out that the pathology of a sprain due to forced abduction at the shoulder is essentially the same as that of a dislocation of this joint.[1] The tear in the axillary portion of the capsule occurs in all, but is most extensive in the dislocation which may be regarded as the type. Hemorrhage must occur in every case and will vary with the number and size of the blood-vessels opened. Some of the large lymph trunks which are numerous here

may also be torn. The extensive opening into the joint is in the most dependent portion, so that the extravasated synovial fluid, blood, and lymph fall by gravity into the loose tissue of the axilla, which has been more or less displaced and lacerated in luxations by the head of the humerus. Ewald [6] believes that traumatic myositis ossificans always occurs in muscles about joints, and is due to the effect of the escaping synovial fluid which infiltrates itself among the muscle-fibres. If this were true, the synovial fluid is capable of inducing a high degree of irritation. The presence of the blood, lymph, and synovial fluid in the axilla, where they surround and infiltrate the various branches of the brachial plexus, and the inflammatory reaction induced by their presence and the associated trauma can account for a marked degree of perineuritis and neuritis in some or all of the nerves in the axilla. According to the number of nerves thus involved and the degree of involvement, we may have a large variety of nervous manifestations, and we need not assume the existence of a direct trauma to the terminal branches of the brachial plexus, the plexus itself, or its roots to account for them. The evidence which I have examined, to my mind, does not seem to indicate that actual nerve rupture in dislocations is especially common. The most frequently ruptured nerve is evidently the circumflex, but I believe that in many of the cases in which the diagnosis is made of a paralysis of the deltoid from a rupture of the circumflex nerve, the nerve is not so much injured as inflamed or bound in cicatricial tissue. I believe also that the marked atrophy of the deltoid seen in these cases is the result, not so often of a complete or a partial rupture of this nerve as of the compression of the nerve by the extravasation and the associated neuritis and perineuritis, of the consequent adhesion, and of the scapulohumeral limitation of movement, which throws the deltoid out of action more than any other muscle because it is the great abductor of the arm.

Delbet and Cauchoix collected from the literature 33 cases in which symptoms of paralysis of the muscles of the upper extremity followed dislocations of the shoulder, and added two

of their own, with another case in which the paralytic condition followed a fracture of the surgical neck of the humerus. The evidence obtained from them, as these writers interpret it, pointed to traumatic lesions of the nerves; and in so far as it was demonstrated by operation and postmortem, it showed involvement of the nerves in the axilla in most cases. In my opinion, these cases can be best explained by the changes produced in the nerves by the inflammatory reaction induced by the extravasated blood, lymph, and synovial fluid, and the trauma of the neighboring tissues.

The autopsy in the case of Th. Anger, performed seven days after the accident, revealed a bloody extravasation of the circumflex nerve to an extent of 2 cm., at the site of the capsular tear and extending into the terminal branches of this nerve. (The circumflex nerve passes backward between the subscapularis and latissimus dorsi muscles, and for a short distance lies directly on the capsule in the immediate vicinity of the tear, so that it is particularly exposed to the exciting causes of inflammation already referred to.) Bardenheuer in operations found intraneurilemmatic effusions, which he thought were produced at the time of the rupture of the surrounding blood- and lymph-vessels. The condition of the nerves was distinctly inflammatory, and he considered it sufficient to cause the conductility of the nerves to disappear by the compression which the inflammation exercised on the nerves. Nicaise found the circumflex nerve swollen, between the inferior borders of the subscapularis and teres minor muscles (the nerve here lies directly on the capsule), and the nerve was enclosed in a sheath of inflamed cellular tissue. The histological examination showed an intense perineuritis. In another case Nicaise found the circumflex nerve bound in dense cellular tissue, in front of the capsule. Panas found a roughening of the circumflex nerve. Vincent determined clinically a paralysis of the median and ulnar nerves, and the case coming to autopsy, he discovered these two nerves surrounded by a zone of thickened fibrous tissue separating the luxated humeral head from the second rib. Müller found a complete disappearance of the

axillary fat, which was replaced by resisting connective tissue. It was difficult to follow the nerves toward the summit of the axilla on account of their adhesions. In Wallis's case the terminal trunks of the brachial plexus were adherent to the periosteum of the humerus just below the surgical neck. Delbet and Cauchoix met with similar conditions in their own three cases.

There is little in these findings to show an actual rupture of the involved nerves, but much to indicate that they had been enveloped in a zone of inflammation due to the lesions in the surrounding structures produced by the dislocations. I believe we may fairly assume that the nerve lesions in those cases of paralysis from trauma about the shoulder, without dislocation, are of a similar character. That actual nerve rupture is not the rule in these cases, as I have seen them, is suggested by the fact that these paralyses tend toward recovery. Either with the assistance of the physician or without it, persistent efforts are usually made to increase the movement in the joint, and this tends to lengthen the contracted tissues, to favor absorption of the inflammatory tissue, and to loosen adhesions, all of which favor a return of the nerves and muscles toward the normal. Many of them, however, fall far short of reaching the normal. Prolonged rest favors a more dense and persistent contraction of the tissues and a more permanent atrophy of the muscles and loss of power. There is a variety of these cases, in which the humeral head falls appreciably below the acromion process, leaving a distinct depression between the two. The joint becomes flail-like, the arm practically helpless, and to a less extent the forearm and hand. This condition is very serious, I believe permanent and sometimes progressive, although my experience with it has not been extensive enough to warrant a positive expression of opinion. I have purposely avoided discussing it here because it deserves more attention than I can give it now.

The following is the only case in which I have had the opportunity of observing the patient from the day of the accident. It presents a few features which are particularly interesting and instructive.

A colored man, fifty-six years old, on June 26, 1910, was found unconscious in the subway, where he was employed as a laborer, and in an unconscious and delirious condition he was brought to the University Hospital, where he was admitted to the service of Professor J. William White, to whom I am indebted for the privilege of reporting the case. Examination showed a cut over the right eye, a contusion on the back of the head, and subconjunctival ecchymosis of the right eye. The pupils were equal and reacted to light, and there was no bleeding from the nose or ears. On the following day on account of his delirium and outcries he was placed in a side room, and because of the violence with which he threw himself about, he was strapped down by the wrists and ankles. In going over the matter later with the interne and the attending nurse, both were positive as to the violence with which he threw about his two arms, and both were satisfied that there could have been no loss of power in them at that time. My own recollection of the patient's actions during my visits, and the fact that he had been strapped down by the wrists confirmed these statements. On the third day the unconsciousness had cleared slightly, and it was observed that he could not raise his left arm or forearm from the bed and that he had very little power in that hand. On the following day there was slight improvement in power in the hand and forearm, but he could not move his arm. On passive abduction at the shoulder after the arm passed a right angle, the patient, who was conscious enough by this time to appreciate it, complained of pain in the axilla and resisted the movement. There was also marked tenderness on pressure in the axilla. On full abduction there was observed a considerable but well-outlined swelling about on a level with the shoulder-joint. It suggested a hæmatoma. Although the mental condition improved very much, there was little change in the condition of the left upper extremity. On July 2, a neurological examination was made by Dr. J. W. McConnell, and the following facts noted: No disturbance of the pupils or of the sphincters. Patient complains of a sensation as if the left hand, forearm, and arm were asleep. The muscles of the whole extremity are extremely weak. Those of the right can be well performed except abduction, which when performed actively or passively, seems to cause considerable pain referred to the shoulder-joint. The same condition obtains on the left side with,

additionally, when the abduction is almost completed, a distinct swelling which appears just behind the pectoral border. This swelling is soft and not to be found on the right side under similar circumstances.

Individual movements can be made as follows: Extension, flexion, and abduction of the fingers of the left hand performed, but much less well than on the right side. Extension and flexion of the hand at the wrist-joint are less well performed than on the right, but better than the movements of the fingers. Pronation on the left side better performed than supination, but both movements better than on the right side. Flexion of the forearm gives distinct contraction of the biceps. Distinct contraction of the supinator longus but much less power than would be expected from such a contraction. Same is true of extension on this, the left side. Voluntary abduction of arm very slight. Attempt at adduction causes distinct movement of adductor muscles but very little movement of arm. Passive rotation of arm on its long axis is fairly well performed, and the excursion is quite as large as in the right arm. Electrical examination shows prompt galvanic response in normal series. There is an area of hypalgesia in left hand, including an area on the ulnar side of the dorsum of the hand up to the styloid process of the ulna and extending over to and including the third metacarpal (middle finger); also over the dorsal surface of the little finger and dorso-ulnar surface of the palm to the median line and fissure in palm, indicating the metacarpophalangeal articulations. Reflexes normal.

I had not observed any trouble with the right shoulder and arm until Dr. McConnell discovered it, nor did I know that the left was involved until the interne, Dr. Sprowl, called my attention to the weakness in the hand and forearm. I concluded that I was dealing with a bilateral tear of the axillary portion of the shoulder capsule. I endeavored to prevent contraction of the capsule by forcing once daily each arm into full abduction. Against the complaints of the patient I persisted in this effort for about two weeks, but the resistance and pain gradually increased and I concluded to give it up. The right shoulder now gave him most trouble, and the resistance was more marked than on the left side. Hoping to prevent further contraction of the capsule on this side, I fixed the shoulder by a plaster cast, with the arm at slightly less than a right angle. The cast was removed nine days later. The scapulohumeral limitation of movement and loss

of power in the arm were more marked than on the left side, on which the loss of power below in the hand and forearm was much more evident.

August 1: The patient had been receiving for several days in the orthopædic gymnasium massage and passive movements, but he now insisted on going home, which he was permitted to do. Although he promised to return for further treatment, he failed to do so.

That the paralysis in this case was not due, primarily, to a traumatic lesion of the brachial plexus, is shown by the fact that for about 48 hours the arms were moving about vigorously, and straps at the wrists were required to restrain them. The first evidence of loss of power was detected on the third day in the left extremity, that in the right arm not until about a week had passed. That the lesions which caused all the trouble were in the axillæ of both sides was clearly evident from the severe pain there on abduction of the arms and the associated scapulohumeral limitation of movement. The localized swelling in the left axilla suggesting a hæmatoma gradually disappeared and was no longer evident when the patient left the hospital. It indicated strongly that its location directly under the shoulder-joint was due to a tear of the axillary portion of the capsule and consisted of a collection of blood from torn vessels, possibly also of lymph and synovial fluid. The pressure of the extravasated material and inflammation about the nerves will account for the gradual development of the nerve symptoms, which appeared earlier on the side on which the extravasation was most marked. The whole clinical picture, to my mind, is one that can be accounted for only by an extensive tear of the axillary portion of the capsule on each side.

In connection with this case I would again call attention to Schulz's observations. Of the 160 dislocations of the shoulder, he studied only the 54 uncomplicated cases, *i.e.*, uncomplicated at the time of the dislocation and the reduction by any nerve paralysis. Therefore, the evidence of involvement of the nerves which developed later can be accounted for only by assuming that it was the result of, and secondary to, the joint condition, as in my case. Schulz so concluded.

Another similar condition, the pathology of which has never been satisfactorily explained, is the infantile obstetrical paralysis, or brachial birth palsy. Duchenne[7] was one of the first to call attention to it. Unfortunately I have not been able to gain access to his contribution on this subject and the following is a translation of his conclusions by H. M. Thomas:[8] "Certain violent obstetrical measures, which may be necessary during the difficult lowering of the arm after the body of the infant has been born, or the strong traction on the shoulder by a finger introduced in the shape of a hook in the axilla, after the head has been born, may at times produce a paralysis of the arm, localized in the deltoid, infraspinatus, and flexors of the forearm, and characterized by the falling of the arm close to the side of the body, the rotation of the arm inwards, and extension of the forearm on the arm. The prognosis of this paralysis is, in general, grave; it may be cured by local faradization, but if this is abandoned, it becomes incurable and produces atrophy of the member." Erb calls attention to the similarity between these cases and those in which the brachial plexus is injured in adults, and believes that they are due to pressure at Erb's point, situated 2 to 3 cm. above the clavicle and somewhat outwards from the posterior border of the sternocleidomastoid and just in front of the transverse process of the sixth cervical vertebra. Stimulation at this point produces a simultaneous contraction of the deltoid, biceps, brachialis anticus, and supinator longus (apparently usually also of the infraspinatus and subscapularis). Thomas says that, why such varying conditions as are known to produce the paralysis should always make pressure at this point, was not explained. Carter was the first to advance the theory that in the great majority of cases stretching of the upper roots of the brachial plexus, and not pressure on the plexus, was the cause of the paralysis. The latter view seems to be the generally accepted one at the present time. Schoemaker[9] collected 95 cases from the literature, and of these, 55 were head presentations and 40 breech. Without going into such a general discussion as the question deserves, I wish merely to

call attention to a few facts, which will, I believe, justify the suggestion that a tear in the axillary portion of the capsule of the shoulder-joint may be the explanation of the condition found in many of these cases. Pressure at Erb's point has never been established as the cause. Stretching of the upper roots of the brachial plexus, with laceration, ought to produce more frequently a more complete and permanent paralysis than is exhibited in these cases. There is a difference of opinion as to the permanency of the paralysis, but most authorities consider that the majority of cases tend to recover more or less completely. The most positive evidence that I have found in favor of stretching of the roots of the plexus is that offered by Clark, Taylor, and Prout.[10] It would seem, at first thought, that their evidence could not be controverted, yet it does not seem that operation for these cases is being generally adopted. Apparently the prime object of their work was to show that many or most of these cases could be cured only by operation. In seven cases seen within a period of two years, they excised portions of the involved roots and sutured the ends together. In one case the rupture involved the entire plexus. Five of the remaining six showed the maximum damage above the junction of the fifth and sixth cervical roots, and one below it. In one, the fifth root was found torn across, and the ends separated about 1 cm. and bound down by connective tissue. In one case the fifth root was torn across just below the junction, and the distal end displaced inward and downward about 2.5 cm. to the front of the scalenus anticus, where it was adherent. They do not refer to any cases not operated on, and one is in doubt as to whether they operated on all their cases. If they did, then they evidently regard the prognosis as more unfavorable than most authorities. In the discussion which followed the reading of Walton's paper,[11] before the American Neurological Association, it was developed that no neurologist present, except Lezynsky, had ever seen an obstetrical birth palsy in an adult. Lezynsky saw one at twenty years and another at seventeen years, in one of which there had been a dislocation at birth. He saw another case in a child in which

there had also been a dislocation at birth. According to the conception of the pathology entertained by Clark, Taylor, and Prout, the usual result of traction is to produce a tear in the perineural sheath, with a resulting small hemorrhage into and beneath the sheath and infiltrating the strands of nerve-fibres and the meshes of the epineurium. In all their operative cases they found the deep cervical fascia invariably thickened, especially over the plexus. An extravasation of blood, lymph, and synovial fluid, 4 or 5 inches upward under the clavicle, from an injured shoulder-joint, with the infant in the recumbent position, would more satisfactorily explain the thickening of the cervical fascia and the cicatricial tissue about the nerve-roots, than would a small tear in the perineural sheath or a rupture of one or two nerve-roots. If the continuity of a nerve-root was broken by traction, the divided ends would probably fall together again as soon as the traction was removed, when we would have a more perfect approximation than could be obtained by the most perfect suturing after the excision of a portion of the root. The cicatricial band of union between the ruptured ends might be difficult to locate and recognize months or years later, in an adherent mass of tissue. The question might fairly be raised as to how a separation of 2.5 cm. between the ends of the divided root is to be explained. In amputations we retrench the nerve-ends, because they do not tend to retract, and if not so treated are likely to become caught in the surrounding scar tissue. There is not enough movement of the surrounding structures to account for so much separation, and the contraction of the cicatricial tissue between the nerve-ends should draw them together. I should regard the theory that traction on the upper roots of the brachial plexus as the cause of these birth palsies is not yet established.

In a head presentation, when the head is born the next step is to deliver one arm, which then occupies a position of abduction. If the scapula did not move with the arm, this would be nearly the normal limit of abduction. Abduction beyond a right angle is permitted by movement of the scapula, which is

produced by tension on the corresponding muscles, and particularly on the axillary portion of the capsule. Traction on this arm to aid the delivery of the rest of the body must apply a dangerous force to the tense axillary portion of the delicate, infantile capsule. H. M. Thomas reports three cases.

The first was seen six weeks after birth. It was a head presentation and forceps delivery. The right arm was born first and traction was made on it. Paralysis of this arm was noticed soon after birth. In the second case, seen eight days after birth, the labor was normal up to the delivery of the head. The delivery of the shoulders was difficult. The anterior (left) shoulder was engaged under the symphysis and was delivered only after considerable difficulty. The head was depressed until this shoulder slipped under the symphysis and was delivered, when by elevating the head (thus forcing the left arm into extreme abduction), the other shoulder was delivered without much trouble. The left arm was paralyzed. It was observed of this case that the shoulder could not be abducted nor the arm rotated outward. In the third case, after a difficult forceps delivery of the head, the shoulders became fixed, and traction was made on the head flexed toward the right shoulder (evidently to deliver the left arm, which must have been forced further into abduction in the delivery of the opposite arm). It was the left arm that was paralyzed. In none of the three were the reactions of degeneration found.

I have referred to these cases because they present some evidence to show that forced abduction was employed in just the arm which was afterward found paralyzed. The most characteristic feature in cases due to a tear of the axillary portion of the shoulder-joint capsule is the scapulohumeral ankylosis, although, as already shown, it can easily be overlooked. If it were present in all birth palsies it would point very strongly to a capsule lesion as the cause of this condition. It cannot be accounted for on the basis of a rupture of the roots of the plexus. It was clearly present in Thomas's second case, it might have been in the others. Schoemaker reported two cases of his own. In one the affected arm was in marked internal rotation, and when it was raised and let go, it fell back. It is not stated that there was or was not resistance to abduction. In his second case, there was marked scapulohumeral ankylosis, almost complete. Duchenne called attention to the internal rotation of the arm, and it was present in all three

of Thomas's cases. It is explained on the basis of the paralysis of the external rotators of the humerus. The theory of a torn axillary portion of the capsule will explain it. Abduction and external rotation drag upon the lacerated capsule and thus produce pain in the early stages. Therefore, the arm is held in the position of rest, adduction, and internal rotation. Later from cicatricial contraction the ankylosis tends to become permanent. The results of treatment in Thomas's cases are suggestive of a capsule rather than a nerve lesion. He employed passive motion, massage, and the galvanic current. The first patient was found dead in bed with its mother three weeks after treatment was begun. In the second case (in ten weeks) and in the third (time not given), the child was practically well when the treatment was abandoned. The treatment was begun early, and in ten weeks the passive motion could have stretched the recent cicatricial tissue easily, and with the massage could have aided materially in the absorption of the reparative new tissue and adhesions of the nerves, the condition of which was probably improved by the electricity. An injury to the roots of the brachial plexus would probably not have recovered so quickly.

Guillemot[12] reports a remarkable series of 12 cases, observed between the ages of fourteen and twenty-five years. The histories showed that all had been delivered either by podalic version or by the breech, and by the same midwife. In 7 cases both arms were paralyzed and in 5, only one arm. Internal rotation was noted in 15 arms, and in 4 it was not observed. Scapulohumeral ankylosis was positive in 13 shoulders, slight in 1, and probably present in the remainder, judging from the associated statements. The paralysis was observed within a few days after birth in all but 2, and in connection with these no statement was made showing when it was first noted. In many of the cases there were associated joint lesions in the shoulders, elbows, and wrists, proving conclusively, says Guillemot, that strong traction must have been made on the arms in delivery. That the condition of the arms was not due to myelitis, was indicated by the fact that

in all, the patellar reflexes were normal and in none was there any weakness in the lower extremities. Sensation was better preserved than motion, and in several cases in which the paralysis was almost total, there was neither anæsthesia nor analgesia. In 11 cases the history pointed to a breech presentation. It will be recalled that of Schoemaker's 95 cases, 55 were head presentations and 40 breech, although for all labors the former are relatively much more common than the latter. The evident relationship between breech presentations and birth palsies has been explained upon the basis of the traction on the after-coming head, and consequently upon the cervical roots of the brachial plexus. It has been shown that the palsy frequently occurs when the birth has taken place without traction on the head. In a breech presentation, when the body is delivered the arms are forced into extreme abduction alongside of the after-coming head, and any turning of the body to one side or the other to assist in the delivery of one arm throws that arm into still more marked abduction. The danger to the capsule is then extreme, so that skill and care would be required to avoid its rupture. The associated joint lesions of the shoulders, elbows, and wrists proved conclusively that strong traction was made on the arms in delivery, as Guillemot said, not on the head.

The main point that I have tried to make is that the pathology underlying many of these brachial birth palsies is that of a dislocation of the shoulder, or its analogous condition, a sprain. The paper of Schulz and that of Delbet and Cauchoix emphasize the importance of the dislocation, in similar cases not occurring immediately after birth. I believe that a careful search of the literature would show that it bears an equally important relation to the birth palsies. Lewis[13] reported a case, which had been diagnosed as a birth palsy and in which a posterior dislocation was recognized and reduced. The patient recovered full use of the arm. Young[14] reported a similar case and directed attention to the frequency with which dislocation of the shoulder is mistaken for birth palsy. He adds that if the dislocation is allowed to continue it will produce a pressure palsy resembling a birth palsy.

Through the kindness of Dr. R. H. McCombs, registrar of the Children's Hospital of Philadelphia, I was enabled to trace a case of brachial birth palsy, which had appeared at the dispensary of this institution, July 18, 1906, when three years of age, on account of an inguinal hernia. It was noted in the history that the patient had a birth palsy of the right arm. He never returned to the dispensary. He is now seven years old. From the mother I learned that instruments had been employed at birth, and that the left humerus and the right clavicle had been fractured, showing that strong traction had probably been made on the arms in delivery. On the following day the right arm was observed to hang helpless at the side. At two months of age, he was taken to a nervous dispensary of another hospital, where the attending physicians are particularly competent to recognize a birth palsy. The visits were not continued long, as the child was too young. At eight months, he was taken back to the same hospital, and again received electrical treatment, which seemed to indicate that a diagnosis of birth palsy had been made, but the mother was never told what was wrong with the arm. When I found him, recently, the arm was hanging at the side, rotated internally, and considerably shorter than the opposite arm (see Figs. 1 and 2). He had regained considerable power, and could abduct the arm to an angle of about 140 degrees. The limitation was due chiefly to a mechanical obstruction at the shoulder, but for which he could probably have raised his arm in full abduction. There was a well-marked wrist-drop and an evident atrophy of the deltoid. Dr. J. W. McConnell, by electrical examination, found a paralysis of the musculospiral nerve. The parents had never been told by any one that the child had a dislocation of the shoulder. Upon inspection the picture was that of a brachial birth palsy, but after palpating the shoulder carefully because of a peculiarity in its shape, I detected a subacromial dislocation. The humeral head could be pushed forward, evidently into the glenoid cavity, but not as far forward as normally. It would not stay in this position if the pressure was removed, and could not easily be held there when the boy abducted or adducted his arm. It seemed to be more easily fixed in the normal position when the arm was in abduction. The patient's brother, now about twenty-five years of age, insisted that he had observed from the birth of the patient that the shoulder was out of place.

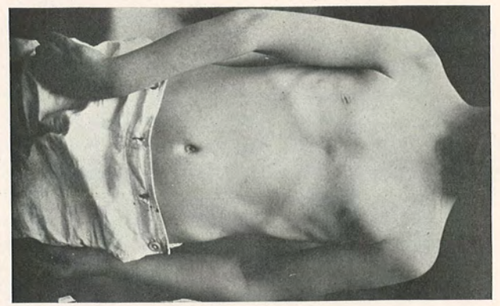

FIG. 1.

Subacromial dislocation of right shoulder, with paralysis of musculospiral nerve. Anterior view. The wrist-drop, shortening of limb, and internal rotation of arm are shown. There is an abnormal prominence at the site of the old fracture of the clavicle.

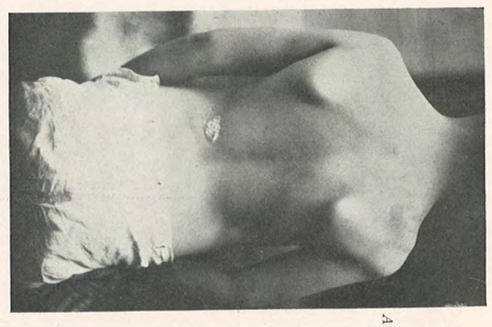

FIG. 2.

A

Posterior view. *A*, abnormal prominence produced by dislocated humeral head. Position of hand shows internal rotation of arm.

On October 28, 1910, he was admitted to the service of Professor J. William White, in the University Hospital, and on the following day I operated on him. The incision was made along the posterior border of the deltoid, which was retracted upward. The tendon of the infraspinatus muscle was divided transversely, the capsule exposed, and the joint opened. The glenoid surface had not the normal cup shape, but was rather convex, with a tendency to slope backward, favoring the slipping posteriorly of the humeral head into the dislocated position. The head was placed in its normal position and the arm held at a right angle with the body while the capsule was shortened to hold the head in this position. The infraspinatus tendon was repaired by suture, and the wound closed without drainage. After the dressings were applied the arm was fixed in nearly full abduction by a light plaster cast, and an opening left through which the wound could be exposed. Healing occurred by first intention and the skin sutures were removed on the seventh day. On about the twelfth day the patient developed symptoms of scarlet fever and was removed to the Municipal Hospital. The cast was there removed two weeks after operation. In about a week the arm could be brought to the side of the body, and the patient was permitted to use it as he lay in bed. On September 2, I saw him at the Municipal Hospital, and then observed that the dislocation was recurring, the tendency of the humeral head being to force its way back to the dislocated position, probably on account of the abnormal shape of the glenoid cup. There was evident at this time a marked improvement in the muscles supplied by the musculospiral nerve, as shown by the disappearance of the wrist-drop. When both arms were held out from the body, the hand on the affected side was held in exactly the same position as on the sound side, *i.e.*, with the palms facing downwards, both hands were in dorsal flexion at the wrist and on the affected side was held in this position without any apparent difficulty. I believe that this degree of improvement in the musculospiral nerve, during the few weeks in which the humeral head was kept in the normal position and the nerve thus probably relieved of abnormal pressure, proves that if the humeral head can be kept in its normal place the arm will become much stronger and a very useful member.

We have here another case like those of Lewis and of Young, in which a posterior dislocation of the shoulder occurring at birth was mistaken for a birth palsy. The clinical picture of birth palsy was present in all three. They show, I believe, that there is a close etiological relationship between the two conditions.

Similar palsies in the adult, from trauma about the shoulder, are due in the great majority of cases, I believe, to tears of the axillary portion of the capsule. While probably true, this is not so clear in the accidents of birth involving the upper extremity. Forced abduction tends to produce an anterior dislocation, but that occurring at birth is almost always posterior. Forced abduction tears the axillary portion of the capsule, but what is the relation between this and a posterior dislocation which must tear the posterior portion also? The following explanation may have some value. There is one important difference in the forced abduction applied to the infant's arm at birth and that applied to the arm in the usual accidents in adults. In the adult the limb is used for defense and is placed or employed by the patient himself, according to the nature of the accident. In the infant at birth, the limb is used as an aid in delivery and is controlled by a second person. In a fall on the hand, which is probably the most frequent cause of dislocations of the shoulder in adults, we have, in addition to the forced abduction, a push in the long axis of the limb in the direction of the shoulder. At birth, assuming that traction on the arm is the cause of the dislocation, we have, in addition to the forced abduction, a pull in the long axis of the limb, away from the shoulder, a force directly the opposite to that sustained in a fall on the hand which produces an anterior dislocation. Since the long axis of the glenoid cavity is oblique from above downward, a strong pull on the fully abducted arm should tend to produce an upward and backward dislocation.

The three cases I have referred to would seem to indicate that a posterior dislocation of the shoulder in the new-born is usually associated with a palsy. If the same condition developed in the absence of a dislocation it would probably be called

a birth palsy. Why not in the presence of a dislocation? Stimson says that paralytic dislocations of the shoulder are particularly frequent in the new-born, and that Duchenne saw eight of this kind in ten years. Panas quotes Duchenne as saying that before his attention was attracted to this complication, he had overlooked it in other cases. According to Panas, Duchenne called attention to the fact that there was diminution of electrical contractility and atrophy of the muscles supplied by the musculospiral and ulnar nerves in these cases. As already stated, I have failed to obtain access to Duchenne's contribution on this subject. In my opinion, there is room for question as to whether all of these dislocations are paralytic, *i.e.*, that the dislocations are the result of associated paralysis. I believe that in my case it was not, but that the paralysis was the result of the dislocation. The reduction of the dislocation in the case of Lewis and in that of Young was followed by a disappearance of the paralysis. In my case the dislocation has existed so long that more or less permanent changes may have taken place in the nerves and muscles, and a return to the normal may be impossible. The prompt improvement following operation, however, is very encouraging. I believe, however, that if the dislocation had been recognized at birth or soon afterwards and had then been reduced, a complete cure would probably have followed. The only positive nerve paralysis at the present time, after the dislocation has existed seven years, is in the musculospiral. Could the dislocation be responsible for this isolated paralysis? The course of this nerve and its relation to the humerus is peculiar to it. In the lower part of the axilla, it begins to pass backward, and then passes obliquely around the upper half of the humerus close to the bone. The backward dislocation of the upper end of the humerus forces the nerve backward with it and must exert an abnormal compression on it, the seven years' existence of which might be responsible for the present condition of the nerve and the muscles it supplies. The results of operation in this case would seem to support this view. Those cases in which there is a depression between the acromion and the humeral head, the

joint flail, and the muscles paralytic, are relatively common soon after birth, but as already stated I expect to take up this subject in another paper, so that I shall avoid its discussion now.

Believing as I do, that in tears of the axillary portion of the shoulder capsule we have a hitherto unrecognized cause of many nervous disturbances in the upper extremity, the pathology of which has been in doubt, I feel justified in suggesting a possible relationship between this injury and some of the craft palsies. In a previous paper [1] I reported a case of stiff and painful shoulder with loss of power in the arm, in which diagnoses of neuritis and of osteo-arthritis were made. The patient is a well-educated man, who was disposed to investigate and to interpret, so far as possible, the meaning and cause of the symptoms of his condition. He was first in the hands of a physician for some months, who was anxious to discover the underlying cause of the trouble, and I had examined the arm for the first time; yet none of us had suspected the existence of the marked scapulohumeral ankylosis, the gradual elimination of which was followed by a disappearance of all the troublesome symptoms. In connection with this case we might consider the one previously mentioned, in which the palsied hand movements returned almost to the normal, so far as freedom of movement was concerned, immediately after the tearing of the contracted portion of the shoulder capsule. If in the second case, as in the first, the trouble in the shoulder had not been recognized, and the patient had been a clerk whose livelihood depended upon the use of his hand in writing, I can imagine the weakness in the hand attracting most attention. I have already reported a case, in which both shoulders were stiff and painful from rheumatism, and in which in one arm a diagnosis of writer's cramp was first made, then of neuritis of the arm by another physician, and of dislocation of the shoulder by a third physician, which was probably the cause of the aggravated condition in that arm. Turner and Stewart [15] say that in some cases the pain is occasionally severe, and affects the upper arm and shoulder as well as the forearm and wrist. They also say that examples of occupation neurosis are

seen in men who undergo repeatedly muscular efforts, as blacksmiths, in whom the upper arm and shoulder muscles, especially the triceps and deltoid, are implicated. Poore [16] says that he recalls cases of writer's cramp in which excessive efforts with a crow-bar, pulling hard upon a rope on board ship, wringing of clothes, and severe traction on one arm while getting off an omnibus in motion were each followed by an inability to perform delicate acts. In the discussion which followed the reading of a paper by Poore [17] on writer's cramp, Godlee referred to a case which had a clicking in the shoulder and a good deal of pain, apparently muscular. The shoulder was supposed to be diseased, as the result of an injury, but Godlee could not make it out as diseased. It would seem, therefore, that many of the craft palsies are distinctly traumatic in origin. It will be recalled that in many of Schulz's cases, which followed dislocations of the shoulder, movements absolutely necessary for many occupations could not be performed at all or only to a slight extent. It is not necessary that the scapulohumeral ankylosis be marked, to be associated with severe pain and weakness in the arm as I have seen in one case. The blood, lymph, and synovial fluid, which extravasated about the large nerve-trunks soon after the original accident, may have induced sufficient adhesions about them to interfere with their functions, and therefore with the functions of the muscles they supply; or as already stated, the weakness in the extremity, including the hand, may be due to the limitation of motion at the shoulder. Erb says of these cases that electrical examination, as a rule, shows no noteworthy changes, and that we are still very much in the dark with regard to their real nature.

The following case, seen recently with Dr. R. S. Dorsett, is very suggestive. The patient, a trained nurse, was thrown violently in a street car collision, striking, she says, against her right shoulder. In consequence she suffered severe pain in various parts of the body, but particularly in her left arm, left leg, and in the back between the scapulæ. I saw her for the first time 26 days after the accident. She then had considerable ten-

derness on pressure between the scapulæ, and since the accident had suffered from pain and numbness in the left upper extremity from the shoulder to the hand, where it involved the three fingers on the ulnar side. An important part of her work is the giving of massage and her chief complaint at the present time is that the loss of power in the left hand interferes with her ability to perform the massage movements. She is very much worried also because, from time to time quite unconsciously, she drops objects from her hand, such as a drinking glass, recognizing the fact only when the crash of the fallen object is heard. In order to establish or exclude a tear of the axillary portion of the capsule, the first symptom I looked for was scapulohumeral limitation of movement, and I found that full movement at this joint could be performed, actively as well as passively. It was not until a week later, on her second visit, that it occurred to me to ask if there had been any pain on movement in the shoulder, and she then stated that she had had much trouble in this respect, but that she had persisted constantly since the accident in forcing the painful and limited abduction. It was only for a few days before her first visit to me that she had been able to perform the full movement. I diagnosed a slight tear of the capsule on the left side, with the possibility of a similar but still milder lesion on the right side. The tenderness between the scapulæ was over the back muscles, which would most resist the associated movements of the scapulæ in forced abduction at the shoulder, which I believe occurred in the original accident. There was more acute tenderness in the left axilla directly under the joint than anywhere else in the body, and I thought that there was still a slight trace of ecchymosis in this axilla, more than three weeks after the accident. About six weeks after the last visit she returned and complained that she could not voluntarily abduct the arm beyond a right angle. On account of pain in the shoulder she had neglected to continue the forced exercises, and the recurrence of the scapulohumeral limitation was the result. The pain and numbness down the arm and forearm to the hand, and the loss of power in the hand, could be satisfactorily explained by a perineuritis and neuritis of some of the branches of the brachial plexus, particularly of the ulnar nerve, due to inclusion in the inflammatory area adjacent to a tear in the axillary portion of the shoulder capsule.

The important fact here is that, four weeks after the accident, when there was little or nothing to suggest a nerve lesion in the axilla, the palsy of the hand should be so marked as to seriously impair her ability to follow her usual occupation, and to cause her to drop such light objects as a drinking glass. There is no doubt in my mind that the weakness in the hand was due to the shoulder-joint lesion, and it seems to me that the case might be classed with the craft palsies. The patient did not associate the hand weakness with the shoulder condition, but regarded it as one of a number of isolated effects of the accident, among which are the pain in the leg, in the back, about the shoulder, and the pain and numbness in the arm and forearm.

Concerning the treatment of these cases, I would place the emphasis first on overcoming the scapulohumeral limitation of movement by suitable exercises and massage, the condition of the nerves and muscles at the same time being improved by electrical stimulation. I would prefer to delay the final determination of the presence or absence of an actual rupture of nerve-fibres and the localization of such a lesion until the movements of the shoulder-joint were normal and the effects of compression or adhesions of nerves had been eliminated. The early recognition of a joint lesion and the associated axillary inflammation is of the greatest importance, but it is likely that the majority of the cases will continue to escape recognition until the conditions become chronic. I have gone over the treatment more fully elsewhere [19] and will now only briefly review it.

In the acute stage, the severity of the pain on movement may demand immobilization of the shoulder-joint. This is done preferably with the arm in full abduction, to prevent contraction of the torn capsule during the healing process, which should be complete in two weeks. This position is awkward, uncomfortable, and difficult to maintain, but the result is well worth the trouble it involves. The Monk splint modified by Codman [2] is a good one for the purpose. A light plaster cast, including the upper part of the chest and arm to the elbow, will

permit more complete abduction, more complete rest of the joint, and will not require as much care as the splint. If there has been a dislocation of the shoulder, it will probably be safest to bind the arm at the side, for three weeks, although I believe that a recurrence could be prevented with proper support by adhesive plaster and a splint which would hold the arm at a right angle with the body. The studies of Schulz show, in my opinion, that the fear of a recurrent dislocation is chiefly responsible for the frequent long-continued stiffness of the shoulder-joint and loss of power in the extremity. I believe that we should balance the one danger against the other, and that with due precautions we can largely eliminate both. At the end of two weeks' immobilization, when there has been no dislocation, the arm should be gradually brought to the side of the body, after which massage and passive movements should be employed to bring about an absorption of the inflammatory material in the axilla, the release of any adhesions which the nerves and other structures have contracted, and thus the return of motion in the joint and of power in the muscles. Electrical stimulation will aid in the more rapid return of the nerves and muscles to the normal.

If the patient is young, strong, and ambitious, the awkwardness of the fixation of the arm in the abducted position may be avoided by permitting him to keep the arm at the side, but with the understanding that forcible exercises are to be employed as soon as the pain will permit and before contraction of the cicatricial tissue sets in. Most cases are first recognized as a serious condition in the chronic stage, when the cicatricial tissue in the axilla is firmly contracted and very resistant. Persistent and long-continued massage and forced movements may gradually stretch the contracted capsule to its normal length, but this will take such a long time that most patients will become discouraged and give up the treatment before it has accomplished the desired result. The breaking up of the resistance under an anæsthetic at one sitting, and the employment of measures to prevent a recontraction of the torn tissues have been very successful in the hands of a few men. Küster[18] found it necessary to repeat the breaking up process frequently in some cases, but this was evidently because he dressed the arm at the side of the body afterwards and permitted the recontraction of the capsule, which could then, however, be stretched more easily because the inflammatory material was more recent and yielding than before the manipulations had been carried out. Küster regarded some very old cases as intractable. I have used this treatment in four cases with very satisfactory results and have not found it necessary to anæsthetize the patient the second time, and I believe that the method will be successful, however old the condition may be. The same efforts as in the acute stage must be made to maintain abduction or to overcome any recontraction, because what we accomplish by the forced manipulations is to produce essentially the same conditions as existed immediately after the original accident.

There are some cases in which the chief complaints are of pain radiating down the arm and loss of power, and in which the movement of the shoulder is so free as to cause a slight scapulohumeral limitation of movement to be overlooked. These are particularly likely to pass for cases of neuritis. In one case of this kind I was satisfied that there was slight abnormal movement of the scapula on passive abduction, and that a contracted axillary portion of the capsule with associated adhesions of the neighboring nerves was responsible for the trouble, which had persisted for eight months and had prevented the patient from following his usual occupation, that of a machinist. Under an anæsthetic I forced the arm into full abduction at the shoulder, with the usual tearing sensation, fixed it in abduction on a splint for a few days, and afterwards forced it twice daily into full abduction. Massage was employed daily, and in six weeks he had obtained nearly full motion, much improvement in power, and was able to return to work at his trade. The slightly contracted capsule was in all probability responsible for most of his trouble. It has not been convenient to employ electricity in some of my cases, but where I have used it there has seemed to be a more rapid return

of power in the weakened muscles. Whenever there is, in the muscles, an impairment of irritability to the electric current, its advantages are obvious.

In connection with the brachial obstetrical palsies, I have had only small experience, but I have been impressed with the idea that care is necessary in differentiating the various cases. I am convinced that subacromial dislocations frequently coexist and are overlooked, and that they are probably birth palsies as much as those in which there are no dislocations. I believe that the dislocation had not been recognized in my case before I saw it. The prompt improvement in the condition of the paralyzed muscles after the imperfect result of the operation proves, I believe, that if the humeral head can be kept in its normal position without impairment of the movement of the joint, the condition of the muscles and nerves will return almost to normal. If the dislocation had been reduced soon after birth, when the glenoid cavity had its normal conformation, in all probability it would have remained in place, and, after a longer or shorter period of "paralytic" symptoms such as probably follow all dislocations and vary according to the degree of involvement of the neighboring nerves by the surrounding inflammation and the effects of later adhesions and compression, the arm would have gradually returned to its normal condition. I would interpret the existence of a scapulohumeral ankylosis in a case of infantile obstetrical palsy to mean that the cause of the paralysis was below the clavicle, not above it. The treatment in such cases should aim at improving the motion of the joint, and in this way releasing the adjacent nerves from the effects of the adhesions and compression which interfere with their function. Electrical stimulation and massage are important in improving the condition of the arm. If after the normal joint motion has been obtained and a reasonable period has been allowed for recovery of the nerves, the paralysis is still of such a character as to justify the diagnosis of a permanent paralysis of one or more nerves below or above the clavicle, the advisability of an operation to free the nerves of their adhesions or to excise a portion and suture the divided ends together may be considered.

CONCLUSIONS.

Extensive laceration of the axillary portion of the capsule of the shoulder always occurs in anterior dislocations of this joint, which represent practically half of all the dislocations of the body. Probably, while the arm is in forced abduction, many others occur, which are spontaneously reduced as the arm falls by gravity to the side of the body immediately after the accident, and the fact of their occurrence is never recognized. Just as the milder lesion, the sprain, is more common at the ankle and wrist than the fracture, which results from a similar but more severe force, so, in all probability, are the sprains at the shoulder more common than the dislocations. We can thus account for a large number of cases in which the same capsule tear occurs.

The extravasation of blood, lymph, and synovial fluid, resulting from such a lesion, falls by gravity into the loose tissues of the axilla, where they surround and infiltrate some or all of the branches of the brachial plexus, giving rise to a non-infectious inflammation, which adds to the already existing compression of the nerves and induces a perineuritis and neuritis. The interference with the function of the nerves caused by these conditions can account for the multiplicity of the nerve symptoms and the fugaciousness of certain symptoms, so that one need not assume the existence of a traumatic lesion of the brachial plexus, its roots, or its branches, to account for them. The post-mortem and operative findings in Delbet and Cauchoix's cases, and the clinical findings in Schulz's cases, support this pathogenesis.

The infantile obstetrical palsies, in which one or both upper extremities are involved, may be the result of a similar axillary condition. This implies that forced abduction of the arm, with or without traction on it and not traction on the head, is the important causal factor. Dislocations at birth give rise to similar palsies, and in these capsule tears undoubtedly occur. The palsies associated with these dislocations are probably completely curable by the recognition and reduction of the dislocations soon after birth.

We may have in unrecognized capsule tears the pathological explanation of many craft palsies. In this connection they at least deserve further consideration.

In traumatic brachial paralyses in adults, in infantile obstetrical, and in craft palsies, the shoulder-joint should be examined for a traumatic lesion, and if evidence of it is discovered, such as a scapulohumeral limitation of movement, the first therapeutic efforts should be directed towards obtaining a return of normal motion in the joint. Operations on the brachial plexus, its roots, or its branches should be deferred until a paralysis from inclusion of the nerves in cicatricial tissue has been eliminated.

REFERENCES.

[1] American Journal of the Medical Sciences, 1911.
[2] Bost. Med. and Surg. Journ., 1906.
[3] Deut. Zeit. f. Chir., 1908, lx, 333.
[4] Revue de Chir., 1910, xxx, 673.
[5] Revue de Chir., 1910, xxx, 817.
[6] Zentralbl. f. Chir., 1910, xxxvii, 771.
[7] De l'electrisation, 1871, 3d edit.
[8] Johns Hopkins Hosp. Bull., Nov., 1910, 279.
[9] Zeit. f. Geburtshülfe u. Gynecolog., Bd. xli, Heft 1, 1899, 33.
[10] American Journal Medical Sciences, 1905, 670.
[11] Journ. Ment. and Nerv. Dis., N. Y., 1895, xxii, 702.
[12] Annales de Gynecolog., 1897, xlvii, 35.
[13] Med. News, Phila., 1895, lxvi, 183.
[14] Annals of Surgery, 1905, xlii, 777.
[15] Text-Book of Nervous Diseases, 1910, pp. 510–511.
[16] Allbutt's Syst. Med., 1900, vol. viii, 3–26.
[21] Proc. Roy. Med. and Chir. Soc., London, 1885, vol. ii, 248.
[38] Archiv f. klin. Chir., 1902, lxvii, 1013.

Dr. James K. Young said that where children have had a palsy of the upper extremity due to subglenoid dislocation of the head of the humerus, this condition is usually mistaken for nerve palsy, but he had frequently discovered the condition to be due to a dislocation at birth, which had persisted. In one case seen by him, in a very small child, the examination was not very satisfactory, but it was shown to be a subglenoid dislocation. In some cases there has been complete restoration of function, in others but partial restoration. After reduction of the shoulder

there is often difficulty with the elbow-joint for some anatomical reason, so that sometimes he had had to also reduce the elbow-joint after reducing the shoulder-joint.

He had performed other operations of this character on three occasions. He had opened the capsule posteriorly and shortened it, making it smaller laterally. This is an original operation, and is not difficult either anteriorly or posteriorly. The capsule is opened by longitudinal incision and a portion removed or folded in and sutured together. The suturing of the capsule is important to maintain the position of the shoulder-joint. He had also removed the tendency to dislocation by division of the contracted muscles. After reduction and shortening of the capsule, the head of the bone should lie in good position without much force. It should remain in position after reduction, and there should be no pulling on the muscles or ligaments, all being so free that the joint remains in position without their aid.

Dr. T. Turner Thomas presented the boy with paralysis of the arm developing at birth, referred to in his paper. He found an overlooked subacromial dislocation of the shoulder, which he reduced by operation. In this case when he got his finger inside the joint, the glenoid surface was felt to be abnormal. That is, it was more or less convex, with an inclination from the anterior toward the posterior edge, tending to favor the sliding out of the head from its normal position. Yet this was not very marked. He wanted to see what a shortening of the capsule would do. In the two months since the operation, the dislocation has been recurring. The point had impressed him that the head ought to lie in place easily and it should not be necessary to depend upon the soft tissues to hold it in afterwards. In this case, however, it tended to force itself out, although it is not now out as far as previously by a good deal. He now proposes, if he can obtain permission, to do what a German surgeon, Hildebrand, did in two recurring dislocations of the shoulder, in which the anterior portion of the glenoid process was absent. The head tended to slide out of the socket anteriorly, so he chiselled away the posterior margin until he made a new socket with a raised anterior margin. Dr. Thomas would try to go in through the axilla and make a new socket in this case, so that the head would stay in place without pressure

upon the ligaments. The striking improvement in the condition of the musculospiral nerve in the short time in which the head was kept in its normal place, leads to the hope that if the head can be kept in place permanently, the boy will obtain a much more useful arm than he has at present.

Dr. Astley P. C. Ashhurst reported the following cases from the services of Drs. G. G. Davis and C. H. Frazier, in the Episcopal Hospital.

I. APPENDICITIS COMPLICATED BY SUBPHRENIC ABSCESS.

Lucy G., age 31 years, negro, admitted to Dr. Frazier's service in the Episcopal Hospital, Dec. 28, 1907. During the night of Dec. 26–27 the patient awoke with epigastric pain, which later centred around the umbilicus. She worked at general housework all morning. She took salts, which made her vomit. She went to bed at 2 P.M. Six enemas were administered, but they had no effect. The next day (Dec. 28), the patient was sent to the Episcopal Hospital.

On admission it was learned that the patient is married, has had two children, the last five years ago. For several years, and until five years ago, had almost constant indigestion, which was attributed to rich food. No indigestion for last five years. Never seriously ill before.

Examination.—Temperature 101° F.; pulse 124; white blood-cells 15,000. Abdomen distended all over and rigid, but especially on right, and more so in upper than in lower quadrant. Very tender everywhere, including *both flanks*. Dulness in right flank. Liver dulness extends a little higher than normal. On percussion, stomach is found distended, and transverse colon is at level of navel. Has not vomited since taking salts the previous morning. No bowel movement since illness began.

Operation.—Forty-four hours after onset of illness an incision was made through the right rectus, above the navel; free pus was revealed on incising the peritoneum. The incision was enlarged up to costal margin; more and more pus kept coming from right flank and from above the transverse colon. Gall-bladder distended, but otherwise normal. Lymph around cystic duct, pylorus, and on anterior wall of stomach. When field

of operation was almost dry, suddenly there came a new flood of pus from above the right lobe of the liver, just beneath the diaphragm; this pus was full of flakes of lymph. When it was all sponged away, the margin of the ruptured adhesions which formed the subphrenic abscess could be clearly seen on the convex surface of the liver. Counter-incision was made for drainage just above the tip of the twelfth rib, and a split rubber tube, filled with gauze, was passed from the abdominal to the lumbar incision. Sand pillow was now placed under lumbar spine; palpation showed no abscess of liver, no opening in diaphragm (as from empyema), no signs of psoas abscess, or caries of spine. Further search along cystic duct, duodenum, and stomach showed no perforation. Finger passed through adhesions around foramen of Winslow showed no pus or gastric contents in lesser peritoneal cavity. Right flank and gall-bladder region remained dry. Gauze drain placed to neck of gall-bladder. The appendix was found on outer side of cæcum, pointing up to flank; it felt very hard and thick. It was acutely flexed on itself about its middle, and its distal half was gangrenous and perforated. Its base was delivered, ligated, divided, and carbolized, but not buried in cæcum; meso-appendix then ligated, and appendix removed. The raw surface left on the ascending colon, between the wide-spread layers of divided meso-appendix, was partly covered in by sutures. Omentum was scanty and *very slimy*. Glass tube showed the pelvis full of pus. Pelvis was drained by glass tube through suprapubic stab wound. Main incision in right rectus (about six inches) closed in layers except at middle, where drains emerged. Time, one hour. Condition good at end of operation.

Head of bed raised, and continuous proctoclysis ordered. December 29: temperature 98.8° F. Abdomen not rigid. No vomiting. A little tearing pain now and then. December 30: temperature 99° F. Doing well. December 31: temperature rose to 101° at 8 P.M. No abdominal symptoms. January 1: temperature 105° F., patient dying. Glass tube replaced by rubber, and new gauze wick inserted beneath liver. No cause found for symptoms. Death at 2 P.M., nearly four days after operation.

Exploration of wound after death showed no pus in upper right quadrant. Lymph and adhesions beneath transverse mesocolon to

left of origin of jejunum, showing the peritonitis to have been very wide-spread at one time. Most of jejunum and ileum were entirely normal. Stump of appendix in good condition. No perforation of stomach or duodenum; gall-bladder normal. Lesser peritoneal cavity shut off by adhesions and not affected. Drainage tube to pouch of Douglas had drained it perfectly dry; there was no pus at all in the pelvis, but a loop of lower ileum was adherent to uterus and bladder, and an abscess containing several ounces of pus had formed between these *in front of uterus*. This was a space which had not been drained. Death evidently occurred from a terminal infection arising in this abscess.

The attack evidently started as an acute appendicitis, pus forming in right flank and pelvis, and extending from right flank to subphrenic region, and from pelvis to left flank and general peritoneal cavity.

II. APPENDICITIS FOLLOWED AFTER SIX MONTHS BY SUBPHRENIC ABSCESS.

Orion L., age 17 years, was admitted to Dr. Davis's service in the Episcopal Hospital March 23, 1908, with a history of being ill for three days with appendicitis. Had a similar attack one year ago. When admitted he had a temperature of 103° F., and a pulse of 128. Abdomen was rigid in right iliac and suprapubic regions, and extremely tender in both places. Not tender in either flank. No mass, no dulness.

Operation, 9.20 P.M. (on third day of illness). Transverse incision (G. G. Davis: *Trans. Phila. Acad. Surg.,* 1906, viii, 160), two inches; on opening peritoneum free pus was found, with no adhesions. Appendix delivered. It was short, subcæcal, much twisted on itself, perforated at its tip, and there was a concretion loose in the abdominal cavity. Appendix removed, stump ligated, and buried in cæcum. Cæcum friable and spotted with lymph. Omentum not seen; glass tube and gauze drain to pelvis. Another gauze strip to right flank, as there was pus here also. In all, seven or eight ounces of pus were evacuated. No record of culture. Inner half of wound closed in layers. Time of operation, 20 minutes.

The appendix was gangrenous, and contained, in addition

to the concretion which had escaped from the perforation at its tip, also another concretion, with a stricture each side of its bed; the thickness of the walls of appendix gave evidence of the former attack. Patient kept sitting up in bed, and given continuous enteroclysis. Subsequent wound healing uneventful.

April 2 and 3: slight fecal discharge from wound. April 22: up in wheel chair. On May 2, was discharged; wound firm, only superficial granulating area.

Sept. 26, 1908, he was re-admitted to Dr. Deaver's service, Episcopal Hospital, complaining of pain in abdomen and right side. In July (two months after discharge) began to have pain in back, especially over eleventh right rib, in posterior axillary line. Pain was considered rheumatic. It has continued to the present. Liniments and belladonna plasters were tried but without effect. Two weeks ago began to feel worse, and confined to bed for last week; several sweats at night, and one chill. Pain in back increased and began to affect abdomen. Was treated for malaria.

He was emaciated, sallow looking; temperature 104.2° F.; pulse 112; respiration 26. A bulging, tender area over lower right ribs, in posterior axillary line. Scar of appendix operation firm, no hernia.

Operation, Sept. 26, 1908, Dr. Deaver: Incision in tenth intercostal space opened into abscess extending between liver and diaphragm, and along thoracic and abdominal walls down to cæcal region. Drain: two rubber tubes, one to cæcum, one between liver and diaphragm. Culture of pus negative. October 2: tubes removed. October 8: temperature normal. October 10: in wheel chair. October 19: discharged.

III. APPENDICITIS COMPLICATED BY VOLVULUS OF SMALL INTESTINE.

Beatrice T., age 13 years, was admitted to Dr. Frazier's service in the Episcopal Hospital, Dec. 22, 1907, with a history of an attack of acute appendicitis of one week's duration. On admission she presented a peritonitic facies, sweet smell to breath. Fecal vomiting. Has passed mucus, but no blood by rectum. Temperature 98° F.; pulse 128; white blood-cells 12,400. Abdomen is very much distended, tympanitic everywhere except in right iliac fossa and right flank, where note is dull;

no change in level of dulness on change of position of patient. Too much distention to feel any mass. Not rigid, not very tender. By rectum finger feels hard and very tender mass in Douglas's pouch. Lungs negative; slight systolic murmur at apex of heart.

Operation, 3.40 P.M. (one week after onset of illness). Etherized while abdomen was being prepared. Percussion of hypogastric region now gave *succussion splash, i.e.,* fluid in air-containing cavity. Incision through right rectus close to median line: omentum presented, adherent to mass of intestine; omentum was full of distended veins, dark yellow and dull. Gauze packs placed. Appendix when delivered was found gangrenous and perforated about one inch from base. Stump ligated, divided, and carbolized, but not buried in cæcum. Glass tube to pelvis gave about one ounce of bloody seropus. Felt many obstructing bands, and found gangrenous small intestine; delivered this, and found a clockwise volvulus of ileum, which was untwisted by giving it one and a half turns in a contra-clockwise direction. This was the gut that was full of fluid and air and that gave succussion splash; it occupied the pelvis, and was the tender mass felt by rectum. The small intestine which occupied the right flank, outside of ascending colon, was also dark blue, distended, and sloughing in spots. Eventration of affected small intestine, with constant hot saline irrigation; this resulted in some improvement in color of highest loops of ileum. Next found collapsed bowel, and traced it up to lower end of distended portion, clamped and divided it, and resected four and a half feet of gangrenous ileum. To relieve distention above region resected, a glass tube was passed up lumen of bowel, as recommended by Monks, emptying upper coils of jejunum of gas and fæces, and thus rendering easier their return to abdomen. Then sutured the divided ends of gut to each other and end on into the wound, making a false anus *en canon de fusil.* Time, 1 hour and 15 minutes.

Patient died about half an hour after return to bed.

IV. APPENDICITIS FOLLOWED BY VOLVULUS OF SMALL INTESTINE.

Frank G., age 16 years, was admitted to Dr. Frazier's service in the Episcopal Hospital, Dec. 7, 1909, with a history of acute attack of appendicitis of over two days' duration. On

admission his temperature was 100° F.; pulse 110; white blood-cells 11,600, with 77 per cent. polynuclears. Abdomen showed small mass close to anterior superior spine of ileum, the rest of abdomen being soft.

Operation at noon (56 hours after onset of attack). Transverse incision of G. G. Davis, three inches long, opening healthy peritoneum on median side of mass. Gauze pads introduced. Light adhesions around cæcum, and gangrenous appendix lying posterior to cæcum; no actual pus. Appendix gangrenous, and had a small perforation on its mesenteric border. Meso-appendix ligated with chromic catgut and divided. In attempting to deliver appendix, it pulled off cæcum, owing to gangrenous state. Stump of appendix at once clamped (no extravasation of fæces), ligated, and buried in cæcum; one bleeding point near ileocæcal valve controlled by separate suture. Cæcum had flakes of lymph on it. Glass tube was passed to pelvis, and a few drachms of thin pus were withdrawn. Culture of pus reported "numerous bacteria, *mixed.*" Drains: glass tube to pelvis, one strip of gauze to stump of appendix, and one to hold small intestine away from incision, inner half of which was closed. Time of operation, 30 minutes.

Patient kept sitting up in bed, and given continuous proctoclysis.

December 8: temperature normal; pulse 100. Given some water early this A.M.; vomited at 8 A.M., after some abdominal pain. Abdomen a little distended in epigastrium. Two ounces of pus from glass tube.

December 9: vomited again. Occasional sharp pains. Rubber tube inserted in place of glass. Epigastrium more distended; no flatus by rectum. Temperature normal; pulse 96–110. Two enemas in evening gave fair bowel motion, very little flatus. *No peristalsis can be heard.* Diagnosis: paralytic ileus. Ordered eserin, grain one-sixtieth, at 3 and at 6 P.M. Gastric lavage relieved distention.

December 10: vomited again, bile only. Examined by Dr. Neilson, who concurred in diagnosis of paralytic ileus, and who advised salts in lavage fluid. No flatus was passed. Soon after this examination, peristalsis could be heard, and just after giving next lavage patient vomited some upper intestinal contents. Examined by Dr. Deaver, who diagnosed mechanical obstruc-

tion and advised operation. White blood-cells 29,600, with 86 per cent. polynuclears.

Second operation, 5.30 P.M. (53 hours after first operation). Ether. Reopened transverse incision; pus between skin and sheath of rectus, edges of drained portion of wound were green; all parietal peritoneum of iliac fossa was gray-green; tube draining pelvis well. Lower ileum collapsed. No cause for obstruction found here. Median incision, from left of umbilicus to pubes; no diffuse peritonitis; upper and left abdomen full of distended coils of small intestine; nothing else seen. Delivered six to eight feet of distended gut, and could then see collapsed ileum; picked it up, determined its direction, and traced it upward. Found that loops of distended gut had twisted around this collapsed gut in a contra-clockwise volvulus. Reduced this volvulus by one full turn in clockwise direction. Tracing collapsed gut higher, found three distinct kinks in loops of ileum lying in pelvis, the adjacent limbs held tightly together, and entirely occluding lumen. Almost gangrenous in spots. Kinks separated, and rent in mesentery sutured. Constant hot irrigation over eventrated bowel. Iodoform gauze wick placed over sloughing area; intestines replaced in abdomen; large rubber tube to drain pelvis; wound closed with through-and-through sutures. Time of operation, 45 minutes.

During operation received one pint and a half of saline solution intravenously; was very badly shocked. Stomach washed out again at end of operation. Returned to bed in exceedingly restless condition, and died 26 hours later, on the fifth day after first operation.

Dr. Ashhurst added that cases such as these represent a fair proportion of the emergency work of a large hospital. Although only one of the patients recovered, a discussion of certain of the features of the fatal cases might prove of interest.

Cases of appendicitis may be grouped for clinical purposes thus: 1. Uncomplicated appendicitis, either acute or in the interval. 2. Appendicitis with abscess. 3. Gangrenous appendicitis. 4. Appendicitis with diffuse peritonitis (no adhesions). 5. Appendicitis with multiple abscesses (numerous adhesions). 6. Appendicitis with intestinal obstruction.

Almost invariably a patient when first seen will fall quite unmistakably into one or other of these groups. The first group

is the least serious, and the mortality is less than 1 per cent. The other groups represent cases progressively worse, and the mortality under any kind of treatment rises by leaps and bounds. These groups are not mentioned in pathological sequence, but in the order of their clinical gravity. Many cases of appendicular abscess have passed through the stage of diffuse peritonitis, operation having been delayed purposely or through ignorance. But not all cases of diffuse peritonitis are converted into the less serious class of appendicitis with abscess; a large proportion of them pass over into the form of peritonitis with multiple abscesses, and from this, or without passing through the intermediate fifth group, they become complicated by intestinal obstruction. It is on account of this uncertainty as to the course which cases of diffuse peritonitis are going to pursue, that Dr. Ashhurst does not favor the treatment advocated by Ochsner, of treating all such patients by gastro-intestinal rest and postponing operation until an abscess forms; because in a number of cases no localized collection of pus will occur at any time, but either multiple abscesses will develop or intestinal obstruction will occur, or the patient will die of septicæmia or a terminal infection before relief is afforded by operation.

The first case reported belongs to the fifth group, that of appendicitis with multiple abscesses, the patient having had, in addition to the subphrenic abscess, pus widely diffused in her abdomen, including the pelvis, both flanks, and the region beneath the transverse colon, as shown at autopsy. The second case, with volvulus which occurred before operation was undertaken, belongs to the sixth group. Both these patients could almost certainly have been saved if operation had been possible at an earlier stage of the disease. It is very much more usual for subphrenic abscess or intestinal obstruction to arise some time after an operation than for operation to be postponed until they are present; and when occurring after operation the prognosis usually is much better.

Probably the most complete statistics of subphrenic abscess are those of Lance (*Gaz. d. Hôp.*, 1909, lxxxii, 63, 99), who collected almost a thousand cases, analysis of which confirms the figures published by others, showing that about 20 per cent. are caused by appendicitis; 30 per cent. are caused by lesions of stomach and duodenum; 13 per cent. are caused by

lesions of liver and gall-bladder; 37 per cent. are caused by lesions of pancreas, spleen, large intestine, pleura, etc.

In regard to subphrenic abscess caused by appendicitis, Lance estimates that it occurs in 0.5 per cent. of cases of appendicitis of all kinds, and in 3 per cent. of cases of suppurative appendicitis. In about two-thirds of the cases it occurred some time after operation, usually in cases of appendicitis with localized abscess. He found only 10 cases recorded in which the subphrenic abscess was a primary development in connection with general peritonitis (as in the first case recorded herewith); and in most of these cases no operation was done, the condition being discovered only at autopsy. Lance found that empyema exists in about 60 per cent. of post-appendicular cases of right-sided subphrenic abscess.

Nearly all cases of subphrenic abscess which follow appendicitis are right-sided. Among 106 cases studied by Eisendrath (*Jour. Amer. Med. Assoc.*, 1908, i, 751), only six were left-sided abscesses; and in the large majority of cases the infection spreads by continuity, invading first the right renal pouch, then the right posterior intraperitoneal subphrenic space, including the subhepatic space, and finally reaching the right anterior subphrenic space around the free margin of the right lateral ligament of the liver.

As pointed out in Barnard's admirable lectures (*Brit. Med. Jour.*, 1908, i, 371, 429), the diagnosis is based on the *history of the case,* the *character of the onset,* the *signs of pus in general, abdominal signs and symptoms, thoracic signs and symptoms, localizing signs,* and, as a last resort, *aspiration.* In the first case reported it does not seem likely that a more accurate diagnosis was possible than was made: there was undoubtedly diffuse peritonitis, and with a history of indigestion, and most marked symptoms pointing to the upper right quadrant, the gall-bladder or upper digestive tract appeared more likely to be the cause of the trouble than the appendix. In the second case, however, not only was there the previous history of an operation for appendicitis with diffuse peritonitis, but there were very positive localizing signs (bulging, tenderness), which rendered diagnosis easy.

The treatment naturally consists in the evacuation of the abscess; and the incision may be anterior, posterior, or lateral.

Lateral incisions are seldom advisable, being suitable only where the abscess is manifestly pointing in the axillary line. Anterior or abdominal incisions are employed in cases of exploration, where the diagnosis is uncertain, and are to be preferred in all cases complicated by diffuse peritonitis, as in the first case recorded herewith. It usually is advisable to make a counter-incision in the loin, for drainage. In the great majority of cases of subphrenic abscess, however, which conform rather to the type of Case II, where the abscess is of slow formation, and where a positive diagnosis is made before operation, the posterior transpleural or subpleural route is preferable.

Volvulus appears to be more frequent in the small than in the large intestine, contrary to the classical teaching; at least in his own experience, which includes four cases of volvulus (two in connection with a Meckel's diverticulum, and the two just reported), there has not been one case in which the colon was affected. At the March meeting of the Academy, Dr. Hodge (ANNALS OF SURGERY, 1910, ii, 271) presented statistics as to the frequency of volvulus, reporting 1 case of volvulus among 61 cases of intestinal obstruction at the Presbyterian Hospital during the last decade, and 7 cases among 57 operations for intestinal obstruction at the Pennsylvania Hospital. Dr. Ashhurst's own experience with intestinal obstruction (apart from strangulated hernias and congenital deformities) embraces only 10 operations, yet 4 of these were caused by volvulus (Case IV, recorded herewith, also presented kinks).

Volvulus seems to be a rare complication of appendicitis, especially when arising before operation. Le Conte reported (ANNALS OF SURG., 1905, i, 148) a case of volvulus of the small intestine occurring two months after appendectomy, which he successfully treated by operation four days after the first symptoms, which commenced mildly; but as there was no mesenteric thrombosis in the affected bowel, he thought the volvulus could not have arisen more than a few hours before operation. When the bowel is gangrenous, as in Case III of the present series, there is nothing to do but resect it; and if the portion removed is high in the intestinal tract, and the patient's condition warrants it, an end-to-end anastomosis should be done; but in cases, as in the present instance, where it is necessary to terminate the operation rapidly, it is better to establish a false anus.

In Case IV, an earlier diagnosis might have enabled the patient's life to be saved. But the differential diagnosis between mechanical and paralytic ileus, while easy in theory, is not always so in practice; and in the absence of projectile vomiting, with no evidence of peristalsis, and with a minimal amount of pain, the existence of mechanical obstruction was not determined until the third day after operation, when pain, peristalsis, and projectile vomiting became noticeable features of the case. Yet on opening the abdomen it was clear that obstruction must have been complete for 24 hours at least.

The *technic of the operation for intestinal obstruction* is one of the least regular and typical known to surgery, and this is perhaps one reason why so few patients are saved by it. It is an accepted fact that it is undesirable to eventrate the distended bowels, and that the collapsed bowel should be sought and traced upward. To find the collapsed bowel it is recommended first to locate the cæcum or transverse colon; if these are distended, the obstruction must be still lower. But in a great many cases, as in Case IV, the distention of the bowels is so great that it is perfectly impossible to see anything else, or even to introduce the hand for search, until the distended coils are removed from the abdomen. But as soon as they are relieved from the pressure of the abdominal wall they become still more distended, and the difficulty of their replacement momentarily increases. Moreover, if we are to believe the physiological researches of Henderson, the acapnia induced by means of these distended bowels greatly increases the shock. In Case III, the use of a glass tube passed up the lumen of the bowel toward the duodenum, as recommended by Monks, quickly relieved the distention and considerably facilitated the return of the intestinal coils to the abdomen. It was not found possible, however, to crowd more than about two feet of intestine upon the tube at one time; but this was sufficient for the purpose in this case. It has been suggested by C. A. Morton (*Brit. Med. Jour.*, March 13, 1909) that the coils of small intestine are not paralyzed by distention so easily as they are thought to be; he holds that kinking prevents the various loops from emptying themselves into one another, and contends that if kinks were absent a single opening in the small gut would be as efficient in emptying it throughout its entire extent as is a single opening in the colon in relieving

distention of the entire large bowel. But the difficulty of overcoming the kinks remains, and several attempts with Monks's glass tube method have not enabled the speaker to overcome the difficulty entirely; the most that it has done has been to promote euthanasia.

Finally Dr. Ashhurst said he should like to secure an expression of opinion from the Fellows of the Academy as to the value of eserin in paralytic ileus. There has sometimes been a suspicion in his mind that its employment has produced mechanical obstruction, by rousing violent peristaisis; and he paraphrased a saying of his father's, that the patient is not sick because his abdomen is distended, but his abdomen is distended because he is sick.

Dr. John H. Gibbon, in regard to Dr. Ashhurst's question relative to the use of eserin, said that if there is a mechanical obstruction in the bowel it will do harm, because it is like giving a laxative or purgative to stimulate peristalsis in a strangulated hernia. If one could only say which cases were and which were not mechanically obstructed one could better gauge the use of eserin. Personally, he thought that most of the obstructions after operation are due to some mechanical cause, and in them, therefore, eserin, or anything of a like nature, is apt to do more harm than good.

Dr. John H. Jopson said that he reported last spring before the Academy three cases of subphrenic abscess following appendicitis out of seven or eight subphrenic infections which he had had in his own practice.

With regard to the case reported in which the subphrenic infection was present at the time of operation, he thought it a very unusual one, in that the case was operated upon when the infection had reached the abscess stage. In these cases which are now subjected to the Murphy treatment, it would seem that subphrenic abscess occurs more frequently than formerly, although he did not mean to say that this was due to the Murphy-Fowler position. Formerly they died of peritonitis before it had time to develop. These abscesses are oftentimes overlooked and cases dying with high temperatures and with collections of pus under the diaphragm are often looked upon as cases of peritonitis elsewhere.

With regard to the location of the appendix in these cases,

in two of his cases it was retrocæcal and very high, and in one of these cases he made a counter-opening in the back in order to avoid a subphrenic infection, but unsuccessfully.

As a point in diagnosis, the presence of symptoms of pulmonary infection, subcrepitant râles, and diaphragmatic pleurisy is of great value in making the diagnosis in the early stage. The presence of râles as a frequent symptom was doubted by Barnard in his classical paper, but it is an important diagnostic symptom.

Dr. George P. Muller, with regard to the use of eserin in intestinal ileus, remarked that he had had brilliant results in a few cases with it. These were, of course, cases of adynamic ileus, generally due to extensive handling of the intestines, especially in placing gauze pads for pelvic operations. He usually tried eserin in any case of intestinal obstruction where he was not sure that it was mechanical in origin. He uses large doses and gives in addition the alum enema as recommended by Dr. Murphy. He did not wish to be understood as advocating delay in the surgical treatment of cases of intestinal obstruction, but wished to state that his experience with eserin in suspected cases of paralytic ileus had been on the whole extremely satisfactory. The advantage of giving eserin at hourly intervals for three or four doses lies in the fact that, unlike medicinal purgatives, it does not increase the fluid content of the intestines but acts by stimulating the muscle of the bowel.

Dr. Morris Booth Miller said, with regard to the use of eserin, that he agreed with Dr. Gibbon that disappointment often attends its use. He had, however, used it routinely for several years in every case where he feared post-operative ileus. He employed it as a precautionary measure, and so far had been so fortunate as not to have this post-operative complication occur. He used it, alternating it with strychnia, and thereby getting more powerful stimulation to the involuntary muscle of the intestine. With this combination one seems less apt to get the poisonous effect of the eserin.

Dr. Robert G. LeConte said, with regard to the use of eserin, he agreed with Dr. Muller. He used it frequently in cases that develop distention after abdominal operation, with the belief that if it does no good it at least can do no harm, and it may perhaps permit of a diagnosis of obstruction due

to mechanical causes to be made sooner than without its use. If it is not effective, it will make the vomiting more obstinate, which may lead to operation the sooner. As Dr. Muller says, it does not increase the contents of the intestines and in that it has marked advantages over the purgatives.

Dr. Astley P. C. Ashhurst, in closing, said he was not partial to the use of eserin. In the case reported it had seemed to rouse so much peristalsis as to cause obstruction. In another case, after operation for typhoid perforation, the abdomen was immensely distended, eserin was given; the man had another perforation, and died.