in size. Upon admission her appearance was very striking, with drawn face, emaciated arms and chest and greatly swollen abdomen; circumference in largest part 54 inches. The weight of patient with tumor was 217 pounds. An abdominal incision exposed a multilocular cyst which was removed, bringing to view multiple myomatous tumors of the uterus, the largest one the size of a man's head, which were removed by partial hysterectomy. The operative shock was controlled by saline infusion. Subsequent uneventful recovery. After the removal of the tumors the patient weighed 115 pounds, making 102 pounds as the approximate weight of the tumors. Among the myomatous masses removed was a small nodule of tissue of a cellular constitution with comparative little intercellular substance and no well defined connective tissue aside from a small amount around a few of the larger blood-vessels; the cells making up the growth were ovoid and spindle shaped, to some extent arranged in fasciculi, particularly the spindle-shaped cells, while the ovoid cells were without such definite arrangements. These cells stained well, showing good nuclei and nucleoli; a few mytotic figures were seen.

Dr. William J. Taylor stated that many years ago he was present when Dr. Keen removed from the abdomen of a girl of 15 a tumor which weighed 118 pounds. The girl weighed 90 pounds after the tumor had been removed. The appearance of the abdominal cavity after the tumor had been removed was most extraordinary, suggesting a disembowelled subject. The girl made a good recovery.

STATED MEETING, HELD NOVEMBER 1, 1909.

The President, Dr. William J. Taylor, in the Chair.

BULLET WOUNDS OF THE CHEST, INVOLVING THE LUNG.

Dr. James A. Kelly reported the histories of three cases of bullet wounds of the chest, involving the lung, which had recovered after thoracotomy.

Case I.—*Bullet wound of lung: Hæmothorax resulting in empyæma: Thoracotomy with resection of eighth rib sixteen days after injury.*—A man, aged 21 years, was admitted to St. Mary's Hospital, September 6, 1907, with this history: While in the act of robbing a freight car he was detected, and while running away was shot in the back, about 12.30 A.M. by an officer. He was admitted to the hospital about one-half hour later. Patient stated that after being shot he was able to walk about one square when he became faint and fell to the ground.

When admitted he was in a state of marked collapse—pale, covered with a cold perspiration, extremities cold, voice weak, markedly dyspnœic. Temperature 94, pulse 140, and respirations 36. When seen about one hour after admission patient was in a state of extreme shock, and symptoms presented were about the same as on admission. Examination of the chest showed an irregular punctured wound about 1½ to 2 inches below the lower angle of the left scapula. Anteriorly, above and at the junction of the third rib and the costal cartilage there could be felt a small hard mass which was apparently the bullet. This could be felt just beneath the skin. Examination of the left lung showed the presence of moist râles at the apex, and an area of dulness extending upward to the sixth rib posteriorly. Marked cellular emphysema of anterior and lateral aspects of the left chest wall. On account of the patient's condition operative interference was not considered. He was given morph. sulph. gr. ¼ hypodermatically and an ice bag was placed over the left chest. From this time the case was treated expectantly, as he had reacted considerably by 8 o'clock the morning of admission. The tem-

perature was then 100 $^{4}/_{5}$ degrees, pulse 160, and respirations 46.

During the first week the temperature was elevated, ranging from 101 $^{2}/_{5}$ to 99 $^{1}/_{5}$, the average temperature being about 101 degrees; at the end of seven days it reached normal once and then varied between normal and 102, until the end of the sixteenth day. The pulse varied between 160 and 104, averaging about 130. The respirations varied between 46 and 24, averaging about 36. The patient did well during the first week, but during the second week his general condition did not improve as well as was expected, so that on the fifteenth day an exploratory puncture was made and a syringeful of bloody purulent fluid was obtained. Physical examination of the left chest at this time showed dulness reaching posteriorly to the second rib, and extending into the axilla. Pulmonary resonance was absent over this area, and above there were diminished breath sounds, and coarse moist râles.

Operation.—Sixteenth day: Ether anæsthesia. Thoracotomy with resection of eighth rib in posterior axillary line. On opening the pleural cavity a large quantity of bloody purulent fluid escaped, a rough estimate being between a pint and a quart. Examination of the pleural cavity showed the lung to be almost collapsed excepting where it was connected to the parietal pleura by soft adhesions. These latter were separated as well as possible and a double rubber drainage-tube introduced. The bullet was then removed through an anterior incision made over its position of lodgement. The bullet was of .38 calibre. The patient reacted well from the operation and the temperature reached normal at the end of the ninth day. At the end of two weeks the patient was out of bed, and he was discharged from the hospital with the fistula completely closed January 28, 1908, four months and three weeks after the injury.

Case II.—*Bullet wound of lung: Thoracotomy and resection of rib about four hours later: Artificial pneumothorax: Recovery.* A man, aged 23 years, was admitted to St. Mary's Hospital, September 11, 1909, soon after having shot himself with a revolver (.22 calibre). He was seen by the reporter about 3 to 4 hours after injury. He was then markedly collapsed, pale, skin covered with a cold, clammy perspiration, temperature 98 $^{3}/_{5}$, pulse 104, respiration 48. Examination of chest shows a small punctured wound, with blackened edges, over the sixth rib, about one inch outside the nipple line. No wound of exit seen, and location of bullet can not be determined. Percussion of left chest shows an area of dulness posteriorly from third rib downward extending into the axilla. Above this area of dulness there is normal resonance; breath sounds are normal excepting for some fine friction sounds. Patient has not coughed up any blood. On account of the patient's general condition and the apparent progressive nature of the symptoms it is decided to explore the pleural cavity and control the bleeding.

Operation: Chloroform anæsthesia. The track of the bullet was followed and it was found to have penetrated the sixth rib. The incision was then enlarged and the sixth rib resected from the costochondral junction posteriorly for a distance of about five to six inches. The pleural cavity was then opened, and was found to contain about one quart of blood and active bleeding from a punctured wound of the lung which was situated about two inches from the free margin and in the lower lobe. A wound of exit in the lung and also a wound of the posterior pleura corresponding to it was present. The blood in the pleural cavity was evacuated by means of dry gauze sponges and it was found by this time that the bleeding had ceased from the lung, which was collapsed. The pleural cavity was then closed with layer sutures except at a point posteriorly, where a double rubber tube was placed for drainage. The patient was returned to the ward in good condition.

Postoperative history: The postoperative temperature rose to 100 degrees, the pulse dropped to 30, and the respirations were 34. At 9 A.M. on the second day the temperature fell to 99 degrees, the respirations were 24, and the pulse 140. The temperature remained about 100 degrees, pulse 110, and respiration 28 on the third day. On the fourth day the temperature was 101 $^{4}/_{5}$ degrees, which fell on the fifth day to 99 $^{3}/_{5}$ degrees. For the remainder of the week the temperature varied between 99 and 101 dgrees. During the second week the temperature fell to normal and the patient was allowed to sit up in a chair. During the third week the discharge, which had been serofibrinous, decreased in amount and the rubber drainage-tube was discontinued, but in a few days was reintroduced and a large collection of pus (about 14 oz.) was evacuated. Since then the patient has rapidly convalesced; the amount of discharge has rapidly

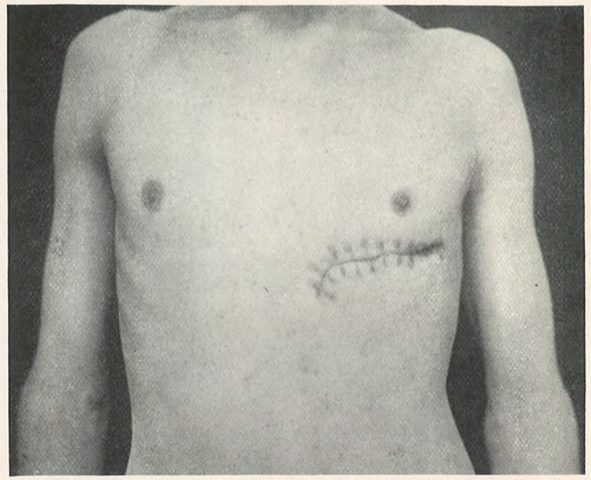
decreased, the lung has expanded so that at present there is a small cavity which contains about 2 ounces of seropurulent fluid (Fig. 1).

CASE III.—*Bullet wound of lung: Thoracotomy with resection of sixth rib one hour later: Sutures of two wounds of lung: Recovery.*—A man, aged 38 years, was admitted to St. Mary's Hospital, September 22, 1909. While suffering from delusions and mental depression the patient had shot himself in the left side of the chest with a revolver of .38 calibre. He was admitted to the hospital about one-half hour after injury, at 5 P.M.

On admission he was pale and anxious. There was marked respiratory difficulty, so that he could only breathe with difficulty when in the recumbent posture. Temperature on admission 99 degrees, pulse 164, respiration 36. Physical examination shows a bullet wound having a large ragged wound of entrance with blackened edges in the left nipple line and sixth interspace. With each inspiration and expiration there is a stream of blood ejected from the wound, which is large enough to admit the tip of the index finger. Examination of the left lung shows all the signs of collapse, with the presence of fluid at the base. As patient's condition was becoming progressively worse an exploratory thoracotomy was decided upon to control the hemorrhage.

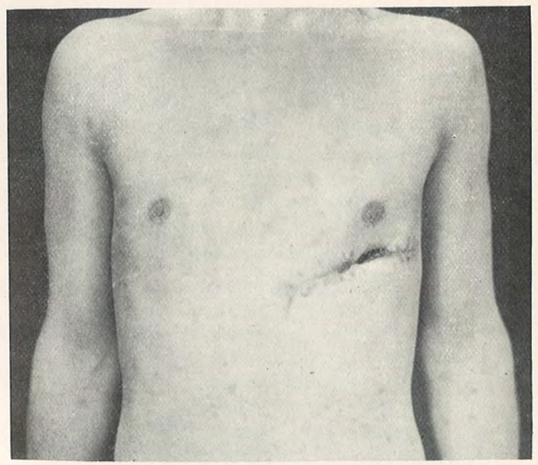
Operation: Chloroform anæsthesia, one and a half hours after injury. Exploration of the wound with the finger showed it to be continuous with the pleural cavity. A transverse incision was then made from the costochondral junction over the sixth rib to anterior axillary line, and the sixth rib resected for a distance of about 5 to 6 inches, and the pleural cavity opened. Exploration of the pleural cavity showed the presence of a large amount of fluid blood, a collapsed lung, and two wounds of the latter—one of the lower lobe about one inch from the free border, and one of the lower and outer portion of the upper lobe near its lower edge. Wounds of exit were present in both lobes. The wounds were large, measuring about 3 cm. long and 1 cm. in width. Both wounds were bleeding very actively. The blood in the pleural cavity was removed with dry gauze sponges and then each lobe of the lung was seized with a flat wide-bladed forceps, separately drawn into the wound and the bleeding controlled by means of interrupted No. 1 catgut sutures. The track of the bullet in the chest wall was excised, and the wound of the chest wall closed with layered sutures of catgut and silkworm

FIG. 1.



Case II.—Photograph taken on the forty-fifth day after injury, showing wound entirely healed excepting for drainage wound at its posterior end.

FIG. 2.



Case III.—Photograph taken on the thirty-eighth day after injury, showing wound entirely healed except at point of drainage at centre.

gut, excepting at the posterior end where a double rubber-tube was placed for drainage. The patient was returned to the ward in a condition of shock, which lasted for several hours.

Postoperative history: At 12.30 A.M., about six hours after the operation, the temperature rose to $100^{2}/_{5}$ degrees, and at six o'clock the temperature was $99^{3}/_{5}$ degrees. The pulse rate fell from its maximum of 164 to 130 shortly after the operation; six hours after it was 120, and the next morning it was 100. The respirations fell to 24 after the operation, and were 36 next morning. During the first week the temperature varied from $99^{2}/_{5}$ to $102^{4}/_{5}$ degrees. The discharge from the wound was at first bloody, but at the end of the week it had become serofibrinous. During the second week the temperature varied from 99 to $101^{4}/_{5}$ degrees; the pulse rate varied from 102 to 90 in the evenings and from 94 to 78 in the mornings, and the respirations varied from 30 to 18. During the third week the patient sat up in a chair and the temperature reached normal. The discharge from the wound became purulent and rather profuse in amount. Since this time the patient has been progressing very favorably. The wound still discharges a small amount of purulent fluid and there is a small cavity containing about 2 ounces of pus. The lung has expanded well and the patient is gradually becoming much stronger (Fig. 2).

Dr. Kelly remarked that bullet wounds of the chest wall involving the lung may be divided into two classes: (1) those in which there is evidence of a hæmothorax or a pneumothorax, but the symptoms of shock and hemorrhage are not severe or progressive in character, and (2) those in which the symptoms of shock and hemorrhage, and especially the latter, are progressive in character. In the first class immediate operative interference is not indicated, but one should delay, and future operative interference should not be considered unless there is evidence of non-absorption of the blood in the pleural cavity, or the hæmothorax has become an empyema. An operation to recover the bullet is not considered advisable unless it is superficial in position, and then only after the signs of shock have entirely disappeared. In the second class of cases immediate operative interference is considered advisable (1) when the symptoms of shock and hemorrhage are progressive in character, (2) when there is evidence of active hemorrhage combined with a pneumothorax (the pres-

ence of active bleeding from a bullet wound combined with a pneumothorax shows that the collapse of the lung has not controlled the bleeding), (3) when there is evidence of increased bleeding operative interference may control it by the production of a pneumothorax, and if the bleeding is not controlled in this manner, direct suture of the lung tissue may readily be performed.

While the opening of the thoracic cavity under positive or negative pressure would facilitate the localizing of the seat of the hemorrhage and lessen the amount of operative shock, yet at the same time it would in all probability have increased the hemorrhage.

While the last two cases were drained the reporter would be inclined to close up the wound in the chest wall without drainage, provided the wound of entrance could be thoroughly excised and the bullet removed.

Dr. John H. Jopson said that very few cases of control of pulmonary hemorrhage by suture are on record. In 1908 Kuttner was able to collect but 6 cases of suture of the lung for gunshot wounds and nine cases of the lung for stab wound, with 6 recoveries. These cases were all reported from the foreign literature. Several years ago Dr. Jopson reported one case of suture of the lung before the Academy for stab wound, which terminated in recovery. It is undoubtedly true that in a number of cases simply opening the chest and establishing a pneumothorax seems to control hemorrhage, but this does not always suffice. In one case of gunshot wound of the lung on which he operated the exploration was undertaken with the idea that the heart had been wounded; the bullet had entered in the third interspace an inch and a half to the left of the sternum, and the symptoms were those of pericardial distention and interference with the heart action. In that case he turned in a quadrilateral flap and had the same experience as had Dr. Kelly in one of his cases, the production of a pneumothorax sufficient to result in the control of the hemorrhage. A laparotomy pad was inserted into the pleural cavity to control active hemorrhage during the stage when the patient's condition was most alarming, and the withdrawal of the pad was followed by arrest of hemorrhage, and he closed the wound immediately. The patient died of delirium tremens on the fourth day without any return of the hemorrhage. In the case of suture of the lung referred to, the hemorrhage

was not entirely controlled by primary exploration and pneumothorax, and a running stitch of catgut to the wound on the edge of the large lobe of the lung was necessary for its complete control. In every case where drainage has been instituted it has been his experience that there has been some infection of the pleura, and this experience has been borne out by the experimental studies of Nötzel, showing the great susceptibility of the pleura to infection where pneumothorax is present. This is not a contra-indication to drainage, because where good drainage is instituted the infection is usually rapidly thrown off. In cases of doubt drainage should be instituted.

Dr. John H. Gibbon said that one of the difficult questions in the treatment of gunshot wounds of the chest is to decide which case should be operated upon and which should be left alone. In most of the gunshot wounds of the lung from small calibre bullets, although the condition may be alarming at first, the hemorrhage usually ceases and the patient recovers. That is one reason surgeons should be careful in the selection of cases. Another is the point that after an operation drainage is necessary, and that whenever drainage is instituted practically always there is infection. These cases reported by Dr. Kelly are rather good illustrations of those in which operation should be undertaken. He thought, however, that a mistake has been made much more often in operating upon cases of gunshot wound of the lung than in not operating. A great many of these cases which look hopeless for a while get well; some develop an empyema later and have to be operated upon, but his own idea is not to operate unless they show such symptoms as those displayed by Dr. Kelly's second case. Stab wounds are more apt to require operative interference than gunshot wounds with small calibre bullets. Gunshot wounds received on the battlefield do not require operation so frequently as do those in civil life.

Dr. Robert G. Le Conte said that the question of drainage in these cases is not always an easy one to decide. He agreed with Dr. Jopson that drainage is apt to be followed by some infection, but whether the infection is due to the drainage *per se*, or to material which has already been carried into the pleura by the primary injury, is a question. When the wound is clean, as it frequently is in a knife-cut, he would have no more fear of draining the pleura than of draining the peritoneum. It is to be

remembered that there are two sources from which infection can take place besides the drainage track: externally from material carried in at the time of the injury, and internally, by the opening of a bronchus. Should infection take place from either of these sources, drainage of the pleural cavity will certainly limit the extent of the pyothorax. When the pleural cavity is clean at the time of operation, there is small chance of infection taking place through the drainage track when properly safeguarded. In the majority of cases the bleeding from the lung will be controlled by the admission of air to the pleural cavity and collapse of the lung, in both gunshot and stab wounds. In his limited experience he had not yet had to suture the lung to control bleeding.

Dr. Francis T. Stewart said that his own rule in these cases is somewhat as follows: If he feels sure that the lung alone has been injured, either by gunshot or stab wound, he does not operate unless the wound is near the root of the lung. Hemorrhage from the lung itself almost invariably controls itself, particularly if some air is allowed to get into the thoracic cavity. He had seen a good many cases in which he had not operated and which had done well. He had explored a number of cases, however, because he thought the heart was injured or that the diaphragm was penetrated. If there is any question of a wound of the heart or penetration of the diaphragm, or injury of the large vessels, exploration should be carried out and hemorrhage controlled. If the parenchymatous tissue of the lung alone is wounded the bleeding usually ceases of its own accord or as the result of collapse of the lung and pneumothorax. There may be cases of large wounds of the lung which will die from hemorrhage alone, and perhaps in some of these cases suture or packing would be indicated.

Dr. John B. Roberts said that one of the interesting features of these cases was the greater rapidity in the cure of the operative cases than in the cases which were allowed to go on until an empyema occurred. He agreed with several of those who had spoken, that gunshot wounds of the lung are frequently cured without operation,—yet he felt that the cases just reported seem to have recovered more quickly than if they had not been promptly opened. He had found in some of these cases which do badly from acute traumatic pneumonia that a prompt phlebotomy has been of service.

Dr. J. E. Sweet said that certain experimental observations had suggested to him a possible mode of infection after wounds of the chest, which might have some decisive bearing upon the question of drainage. The phagocytes can take up bacteria from the alveoli and possibly the bronchioles of the lung; such phagocytosed organisms are not immediately killed in the body of the leucocyte. These phagocytes normally wander to the spleen or bone marrow, perhaps; but an irritation of the pleura might attract them to the wound and the organisms becoming free, an infection could result.

THE TREATMENT OF GANGRENE OF THE FOOT BY ARTERIOVENOUS ANASTOMOSIS.

BY GEORGE P. MULLER, M.D.,

OF PHILADELPHIA.

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It is not necessary to refer at this time to the brilliant series of experimental observations whereby it has been shown that it is possible to divert the blood from an artery to a vein by an end-to-end anastomosis of the two vessels. The work of the experimental laboratory has been applied to the human being, and in this paper I report the tenth case in which an attempt has been made to stay the advance of gangrene of the leg.

In 1902 San Martin, stimulated by the work of Gluck, reported that he had operated upon two patients suffering from gangrene of the leg. He performed a lateral anastomosis between the femoral artery and vein. In one case amputation was performed at the same time and there was no further spread of the gangrene; the other was a complete failure. In the same year Jaboulay reported a similar operation on a patient suffering from gangrene produced by endarteritis. It was not successful and amputation became necessary later.

Hubbard in October, 1906, recorded the case of a man, aged 80, in whom he established an end-to-end anastomosis, by the invagination method, between the femoral artery and vein in Scarpa's triangle, for senile gangrene of the foot. A double anastomosis was done to effect reversal of the circulation. While no pulsation was observed, the leg did not become swollen or cold, its nourishment apparently being satisfactory. The gangrene spread until the lower half of the foot became blue and a line of demarcation appeared. Amputation was then performed.

Torrance in 1906 made an end-to-end anastomosis of the anterior tibial artery and internal saphenous vein in a case of crush of the foot and leg. The anastomosis sloughed.

Lilienthal in 1907 operated on a case of angiosclerotic gangrene and performed an end-to-end anastomosis in Scarpa's triangle. Eighteen hours later a line of demarcation formed, crossing the upper portion of the dorsum of the foot, thence up the sides of the leg and crossing the calf 7 or 8 inches above the point of the heel. Death occurred 31 hours after operation from shock. An examination of the anastomosis showed a smooth union with an extremely soft clot in the vein, possibly formed just before death, when the circulation was at its lowest ebb.

In 1907 Hubbard reported his second case in which the anastomosis was done by the invagination method, the distal end of the artery and the proximal end of the vein being ligated. The case was a distinct failure as it was necessary 10 days later to amputate above the knee.

In May, 1908, Ballance reported a case of arteriovenous anastomosis for senile gangrene in a woman aged 75. The gangrene began in the toes and three weeks later the skin over the dorsum of the foot began to show discoloration. An end-to-end anastomosis was performed. A few hours after operation the internal saphenous vein could be felt pulsating and visible pulsation was seen in the veins on the dorsum of the foot, but this did not persist, as two days later the pulsation was barely perceptible. "The immediate effects of the operation were striking; arterial blood was transmitted by way of the veins to the foot, the warmth of the foot was increased, the advance of the gangrene (obvious before the operation) was stayed, a definite line of demarcation appeared on the inner three toes, and the skin proximal to the line of demarcation again became sensitive so that light touches were readily located." From this time on the gangrene of the foot was arrested. Four months later the patient was seized with acute abdominal pain and died 24 hours later. Autopsy disclosed a gangrenous condition of the cæcum, ascending and

transverse colon. The anastomosis between the femoral artery and the vein was closed by scar tissue.

In July, 1908, Wieting, of Constantinople discussed the operative treatment of angiosclerotic gangrene and reported a successful case in which he intubated the femoral artery into the femoral vein. The patient, a man 40 years old, had had the right leg amputated a year previous. The foot and ankle were cold, and livid in color, and the seat of tingling pain; the patient stated it was exactly as the other foot had been at one time before the progression of the gangrene warranted amputation. Immediately following the anastomosis the foot became warm, the toes red and the pains and paræsthesia disappeared. No pulsation of the veins was seen or felt. Two months later the foot was warm and all symptoms had disappeared.

In November, 1908, Lund reported that he had operated upon a man, 32 years of age, who suffered from coldness and mottling of the foot, several sluggish ulcers on the dorsum and toes and absence of the posterior tibial and dorsalis pedis pulse. The condition had been caused by frost-bite nine months previous, although even before this he had had pain and a tingling sensation in the left foot. An end-to-end anastomosis of the femoral artery and vein was made with mattress silk sutures, everting the intima. The foot immediately turned from white to a deep pink and the superficial veins filled out. The first toe became gangrenous and was removed 11 days later and as the flaps became gangrenous the leg was amputated, three days later, 4 inches below the knee and the wound healed by first intention.

In the same year, December, 1908, Hubbard reported a third case of a woman, 84 years old, who three months before had had an amputation done of the right leg above the knee for gangrene of the foot. Subsequently a necrotic ulcer appeared on the left heel, and fearing gangrene an arteriovenous anastomosis was done according to Carrell's method. Two weeks later the foot was warm and comfortable and the patient up in a wheel chair. Five weeks after operation "it was

noticed that without any apparent reason the whole leg had become decidedly œdematous. From this time there was no very marked changes in the local condition except that a cool area about 3 inches wide, encircling the middle of the leg, appeared, while the foot and upper leg remained warm. The sloughs on the heel and over the big toe began very gradually to extend and a bed sore which developed over the sacrum showed no improvement. The general condition of the patient became gradually poorer and she gradually failed and died from senility" 9 weeks after operation. Examination of the site of anastomosis after death showed perfect healing but a thrombus at the point of union was found which was undergoing organization. The age of the thrombus could not be decided and the result was, therefore, in doubt.

The next case was reported by Armour and Smith in September, 1909. The patient, a man 69 years old, complained of swelling, cold, and feeling of pins and needles in his right foot. The arteries were tortuous and thickened, the pulse tension not high and the circulation very sluggish. The pulse could be felt in the right femoral artery but not in the popliteal below it. An end-to-end anastomosis was done and the internal saphenous ligated in the upper part of the thigh. Four days later a line of demarcation formed at the level of the upper and middle thirds of the leg on the outer side and of the lower and middle thirds on the inner side. Above this the leg was warm and the superficial veins were actively conveying blood and were somewhat distended but not pulsating. Fourteen days later the leg was amputated above the knee and when the tourniquet was loosened the tied vein was seen actively pulsating just as an artery would. The latter was filled with clot. The popliteal vein was found thrombosed below the highest set of valves.

Three weeks ago, October 7, 1909, Hubbard reported his fourth anastomosis for senile gangrene in a man aged 77 years. An end-to-end anastomosis was done by the Carrell method. At the close of the operation the circulation in the foot re-

turned as quickly as before. The discoloration and mottling of the foot were greatly improved but pain was marked. Later œdema of the leg appeared and pain was so great as to require morphine. About five weeks after the anastomosis, amputation above the knee was necessary owing to the pain. When the tourniquet was loosened red blood was seen to spurt from the femoral vein.

To these cases I wish to add the following:

J. F. M., aged 51 years, was admitted to Dr. Frazier's service in the Philadelphia Hospital, June 29, 1909. Two weeks before admission his left foot began to pain and tingle and to become blue, cold and mottled. When admitted he was found to have a gangrenous fifth toe and gangrenous patches on the remaining toes. He was poorly nourished, tall and gaunt and had marked arteriosclerosis of the radial and temporal arteries. The dorsalis pedis pulsation could not be felt. He was treated along the usual lines until July 19, 1909, when it was feared that the gangrenous process was advancing. On that day, under spinal anæsthesia, end-to-end anastomosis was effected, by the Carrell method, of the femoral artery and vein at the apex of Scarpa's triangle below the origin of the profunda femoris. Complete reversal was not attempted. The artery was moderately sclerosed. When the clamps were removed the vein was seen actively pulsating and continued to do so during the closure of the wound with catgut for the deeper tissues, silkworm gut for the skin. The leg and foot became warm, the leg red and the foot reddish purple in color. No visible pulsation of the veins was observed. In 48 hours the foot was cold to the ankle, the leg warm and on the third day a line of demarcation began to appear at the tibiotarsal joint. This became more marked in a few days and amputation at the middle third of the leg was advised but the patient refused to have it done. From this time until September 3, 1909 (40 days), the patient was absorbing toxin from the gangrenous foot and was gradually getting weaker. About September 1, he became delirious and, permission being obtained from his relatives, the leg was amputated 4 inches below the knee. At this time the posterior tibial and peroneal veins showed feeble but distinct spurts of blood. There were many unusual sharp oozers. The anterior tibials did not bleed. All the arteries and the external saphenous vein were thrombosed. The internal saphenous vein was patent. The flaps were loosely sutured together and drainage provided. There was much suppuration in the flaps and despite energetic systemic stimulation death occurred, apparently from exhaustion, on September 20, 1909, nine weeks after the first operation. An autopsy was refused and we were forbidden to examine the seat of anastomosis.

If we omit the cases reported by San Martin and by Jaboulay where a lateral anastomosis was performed (this method having been shown to lead to failure), and that of Torrance which was done for crush, we have ten cases of arteriovenous anastomosis deliberately made in the hope of staying the progress of gangrene of the lower extremity.

In this series there were 7 males and 3 females. The ages ranged from 32 to 84 years and averaged 63 years. Senile gangrene was the term used for the disease for which the patients required relief with the exception of Wieting's case which was termed angiosclerotic gangrene and Lund's case which was probably obliterating thromboangitis.

The exact pathology of the various forms of gangrene is still rather unsettled, but it does not make any material difference whether the artery is obstructed by an obliterating endarteritis or simply by a sclerosis provided that thrombosis of the veins has not occurred. That thrombophlebitis is not an uncommon occurrence in gangrene has been shown by the excellent papers of Buerger, and if it should exist to any extent the performance of arteriovenous anastomosis would be foredoomed to failure. In my case I practised the method advocated by Buerger for ascertaining the patency of the deep veins and apparently found no impairment of their function.

Of the ten cases, one died apparently from shock (Lilienthal) 31 hours after operation. Three others died at periods varying from 8 to 16 weeks after operation Ballance, Hubbard's third, Müller) from causes mentioned above. Of the remaining six, Wieting claimed a perfect result two months after operation and Hubbard's fourth case was progressing favorably until extreme pain required amputation; these were

the only two cases operated upon early. The remaining four (Hubbard's first and second, Armour and Smith, Lund) required amputation either at the "point of election" or above the knee at varying periods after the anastomosis.

"If we deflect the arterial current from the femoral artery into the femoral vein, below the termination of the long saphenous, we do so with a view to establishing the following conditions: (1) the deep veins are to be transformed into arteries; (2) the blood must find its way into the capillaries where it meets the blood from the profunda and the capillaries; and (3) a new centripetal flow must be established, primarily through a set of interanastomosing deep venules, but in the main finding its way into the vast network of superficial veins that empty in the long saphenous and thus into the femoral." (Buerger.)

There are, of course, two serious objections, theoretically, to the success of the operation: (1) the presence of valves in the popliteal vein and (2) the obstruction in the arteries tending to drive the blood from the deep to the superficial veins before the capillary system is reached. In 1903 Gallois and Pinatelle stated that according to their experiments the valves formed an insuperable obstacle to arteriovenous anastomosis, but Carrell has shown that the living tissues have great power of adaptation and that the valves are forced in a few hours, thus allowing for the reversal of the circulation.

As to the second objection the cases on record show that the blood *does* reach the tissues of the foot, but I am of the opinion that if the tibial arteries are occluded the blood barely reaches the dorsum and simply suffices to insure nourishment to the tissues at the "point of election" for amputation. It has been proposed (Buerger) that the ligation of the external saphenous would enable more arterial blood to reach the leg and foot, but it has not been performed in the cases on record. Armour and Smith ligated the internal saphenous but accomplished nothing, nor is this procedure to be recommended, as the long saphenous is needed as the efferent trunk where complete reversal of the circulation is impossible by reason of the obstructed arteries.

An objection has been raised by Ross that division of the artery and vein destroys the nervi arteriorum and that the loss of tone thus induced must favor thrombosis and that, therefore, the effect of the operation is exactly as in ligation, the collaterals supplying the blood to the tissues below. But I think it is pretty well established by the experimental work that the plexi surrounding the vessels must be to a great extent automatic in action and not dependent entirely upon impulses from the sympathetic and spinal fibres. There is undoubtedly some change in the nutrition of the vein wall and this, together with the changed conditions of pressure, results in an increase in the thickness of the wall of the vein.

Finally I would offer in conclusion:

1. That in the early stages of arterial disease producing ulcers on the toes, erythromelia, extreme pain, tingling, etc., a complete reversal of the circulation *may* relieve the condition if other measures have been tried and failed.

2. That with gangrene of a toe established, one should wait for a line of demarcation. If the process involves several toes or tends to spread to the dorsum of the foot an anastomosis between the femoral artery and vein with ligation of the external saphenous *will almost certainly* induce a line of demarcation in the region of the ankle.

3. That if the superficial and deep veins are also thrombosed the operation is useless and should not be done.

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Dr. J. E. Sweet said the fact of the previous operation in Dr. Müller's first case leaves little opportunity for discussion; the operation chosen was the only surgical possibility. Had it not been for the first operation, the use of formalinized arteries would have come into the discussion. They had been surprised in the laboratory to note the slight reaction caused in the substance of the brain by an artery hardened in formalin. The suggestion to use such material in aneurysms seems practical, but he did not know of its having been tried.

It sometimes seems as if the workers with human material were somewhat slow to adopt the suggestions of the laboratory. Possibly Dr. Müller's second case is an example of the reason why the laboratory suggestions are not more readily adopted, they are not always practical, as in the suggestion of the transposition of the circulation for gangrene which is hardly practicable. If the course of an artery to its capillaries is followed it will be found that the blood gradually becomes venous from the processes of anabolism and katabolism; in other words, the capillaries, upon which the life of the tissue depends, are half venous, half arterial. If the blood will not pass through the arterial half of the capillary, when pursuing its normal course, one fails to see how it can if led to the capillary from the venous side.

Dr. George P. Müller added that it does not seem feasible, physiologically, to effect reversal of the circulation, but Carrell reports having done so in dogs. Of course if the artery is thrombosed it is impossible to effect the reversal, as the blood must leak through the large veins which unite the deep and superficial venous vessels, and therefore fail to reach the foot. It is impossible, if gangrene is once established, to send sufficient blood to the foot to prevent gangrene from spreading beyond the toes, but he believed it to be possible almost always to obtain sufficient circulation to enable the amputation to be done in the leg.

MALIGNANT DEGENERATION OF BENIGN DISEASES OF THE BREAST.

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The advances made in surgery of the mammary gland have been due, to a considerable extent, to the aid furnished by pathologic studies. The subject of benign tumors of the breast was obscured for many years by a lack of uniformity in nomenclature, a confusion which has been dispelled by a suitable classification of these affections. Recent pathologic studies of benign breast diseases have elicited a very important fact, namely, that a fairly high percentage of the benign tumors and diseases of the breast undergoes a secondary malignant degeneration. A study of certain types of benign tumors, with the object of determining the approximate percentage of malignancy and the signs by which it can be recognized, should be of value from the prognostic and surgical standpoint.

In reporting the following cases, Warren's [1] classification has been followed. The cases examined are used as types of the various benign affections, the discussion following is based upon the most important recent communications of the subjects in question.

Fibro-epithelial tumors.—Warren divides these tumors into two divisions—the fibrous type and epithelial type. In the first group are included the periductal fibroma, the periductal myxoma and the periductal sarcoma. The second division comprises a class of tumors which are rather uncommon—the cystadenomata—which are subdivided into the fibrocystadenoma and the papillary cystadenoma.

The periductal fibroma (adenofibroma) occupies an important place from the standpoint of frequency, occurring in 7 per cent., whereas the entire group of fibro-epithelial tumors comprises 11 per cent. of the entire number of breast diseases. Warren has advocated the terms "periductal fibroma" because the chief constituent of the fibro-epithelial tumors of the fibrous type is the peculiar periductal tissue of the breast. This tissue develops at a time when the majority of the fibrous tumors occur, between puberty and lactation; it is part of the structure of the breast, and its close relationship with the epithelial elements makes it impossible for one type of tissue to undergo tumor formation without involvement of the other. The name "adeno" is reserved by Warren for the tumors in which the epithelial elements play a more important part.

The clinical features of periductal fibromata are too well known to warrant any extensive discussion, although certain deviations from the usual type encountered are of interest. The growth occasionally progresses steadily until it reaches enormous size, weighing, in some of the cases, as much as eight or ten pounds. In such instances, as reported by Finsterer,[2] Anger [3] and others, the patients are advanced in years (forty to fifty) and the growth is of many years duration. Cases have been reported in which benign tumors have been present for a period of ten to twenty years before malignancy developed. Ulceration of the skin, cystic degeneration of the tumor, a constant increase in pain and enlargement of the axillary lymphatic nodes may occur. Such symptoms are highly suggestive of malignancy, but microscopic examination of the tumor may not show evidence of carcinomatous formation. Fortunately this type of rapidly growing but benign tumor is becoming rare, because few are permitted to reach such size without operative interference. Therefore, the more common type encountered is the small, well circumscribed, single or multiple tumor. Sufficient histologic evidence is present to prove that this form becomes malignant, although clinical facts pointing to a recognition

of this complication are not numerous, and not infrequently the microscope shows quite accidentally that the tumor removed has undergone carcinomatous degeneration. Anger[3] reports a case in which islands of cancer were present in a fibroadenoma, which in spite of its large size (7 k.) and long duration did not appear malignant. The skin was normal, the tumor freely movable and the axillary lymphatics were uninvolved.

Microscopic studies of the secondary epithelial changes in benign tumors have been more numerous in connection with abnormal involution and with the cystadenomata. While fewer cases are on record of malignancy occurring in periductal fibroma, yet the underlying changes are practically the same as in other conditions. Kuru [4] believes that the carcinoma, in such instances, arises by means of active epithelial growth which is associated with a simultaneous adenomatous proliferation, and he agrees with Müller,[5] that the process begins as a multicentric formation. Some pathologists deny that cancer occurs secondarily to benign tumors, and claim that it takes its origin from misplaced cells,—that the two tumors grow independently and finally become associated by the enlargement and infiltration of the carcinoma.

Sudden enlargement of a previously existing latent tumor should always be regarded as a suspicious symptom. Axillary involvement is not always conclusive, as it may be of inflammatory origin and was found by Finsterer [2] seven times in sixty-four benign conditions of the breast. Rapid growth of a benign tumor may be associated with ulceration, loss of weight and weakness, so that the symptoms of an early cachexia are simulated.

A tumor, previously movable on the underlying structures, which becomes adherent presents one of the most reliable signs of malignancy; but this symptom does not occur until the disease has become well advanced. Dimpling or adherence of the overlying skin should always be regarded as highly suggestive of carcinoma. Pain seems to be a variable symptom in benign lesions of the breast. Its occurrence has been

noted by many writers, but when associated with rapid enlargement of the tumor (and particularly when the severity of the pain constantly increases) a malignant degeneration should be suspected.

Statements as to the cause of malignancy in benign affections are rather scanty although traumatism and pressure are supposed to play an important rôle. Elsasser [6] observed a case in which exposure was said to have caused rapid growth and malignancy of an adenofibroma. An hereditary predisposition was present in both of the cases which this author has recorded. An associated mastitis or lactation may be injurious to benign tumors; the effect of pregnancy is discussed under the second case reported. Several of the cases recorded have occurred in women who have never borne children, nor have suffered from previous diseases of the breast.

We find, therefore, that certain tumors which present symptoms suggestive of malignancy do not show the histologic changes of the same, and, on the other hand, carcinoma occasionally arises in a prëexisting tumor without causing symptoms indicative of such a transformation. We can conclude from these statements that operative interference in all tumors of the fibro-epithelial type is indicated to prevent this complication.

In the Laboratory of Surgical Pathology, University of Pennsylvania, two instances of carcinomatous changes in periductal fibroma have been observed in 17 cases studied pathologically. In both there were one or two symptoms which were only suggestive of cancer. In the first case the skin was not freely movable over the tumor, and in the second an enlarged hard axillary lymph-node was present. Beyond these doubtful symptoms, there was no evidence of carcinoma which was not seriously considered in either case.

The clinical histories and pathologic descriptions of the two cases follow:

Case I.—M. J., aged 45, unmarried, was admitted to Dr. Frazier's service for a growth in the left breast of seven months

duration. The tumor was not painful, had grown slowly until it reached the size of an egg, and seemed to the patient, to be slightly more fixed than formerly. Patient cannot recall any injury to the breast, and she has never had any soreness of the nipple. The tumor was situated to the right and passed beneath the nipple which is normal. The skin was movable over the growth but not freely, and the tumor was entirely movable over the chest wall; it was not painful on palpation, but hard. The axillary lymphatics were uninvolved.

Operation: The tumor was found to be well encapsulated, presenting the characteristics of a benign growth; it was not deemed necessary to perform a more radical operation than removal of the tumor with the surrounding skin and all glandular tissue—a precaution which was made on account of the patient's age. The patient recovered from the operation and when seen 22 months later showed no signs of a recurrence.

Specimen on examination consists of the breast, and surrounding fat. The skin is freely movable and unchanged in appearance, the nipple slightly retracted. A small nodular mass is palpable through the skin but has no relationship with the nipple. On the posterior surface a well circumscribed, round encapsulated tumor the size of an egg is seen embedded in the breast tissue. The mass is not adherent to the surrounding tissue and presents on section a reddish white appearance. The red areas are soft, contain a few small cysts, and are directly continuous with the white indurated portion which cuts with more difficulty than the other part of the tumor. The induration is almost the size of a pea, and represents but a small proportion of the tumor from which it so differs in appearance that the impression is given of tissues of different type. The remaining portion of the breast on careful examination, particularly the nipple region, is free from gross change.

Microscopically, the sections taken from the tumor show a proliferation of the periacinous fibrous connective tissue which is quite cellular and completely surrounds the ducts and acini. The latter are regular in appearance, and are lined for the most part by a single layer of cuboidal epithelium. Many of the ducts are dilated, forming small cysts, the lining cells are low and a few papillary projections are seen within the lumen. The fibrous overgrowth has compressed many of the cystic dilatations so

that they appear as slits, resembling the form of tumor described as pericanalicular fibro-adenoma.

The second portion of the growth retains the appearance of a periductal fibroma, but in addition an epithelial hyperplasia is present. This occurs in many of the acini and ducts which are filled with cells which have no tendency to infiltrate the fibrous stroma. The cells, for the most part, are regular in appearance; in some acini many layers are present and here some irregularity in the shape of the epithelium is seen. In many areas the circumscribed appearance is lost, and the epithelium infiltrates the connective tissue spaces as thin lines or processes. In other places the cells are heaped up and form small collections in the tissues; a glandular reproduction, however, is not present. The tissue in which the malignant degeneration has arisen is to a slight extent invaded by leucocytes, shows considerable dilatation of the blood-vessels and some free blood in the tissues.

Examination of the breast tissue surrounding the tumor and in the neighborhood of the nipple shows changes of involution. Pathological diagnosis: Periductal fibroma, carcinomatous degeneration.

Case II.—The patient, aged 45, had noticed a growth in the upper and outer quadrant of the right breast for six years. It was painless, of slow growth, and did not produce any symptoms. Her last child was born 10 years ago; she has not had any previous breast disease. About four months ago she became pregnant, and shortly afterward noticed that the tumor began to enlarge, but did not become painful. On examination a small, well circumscribed tumor was discovered in the breast and a single enlarged node in the axilla. In view of the rapid enlargement and lymphatic involvement, her family physician advised removal of the tumor, which was done by Dr. A. C. Wood.

Specimen consists of a tumor about the size of a hazel nut, the surface is pale and the cut surface smooth and rather fleshy in appearance. The tissue is arranged in concentric bundles, and has a firm consistency. Attached to the tumor is a mass of fat and muscle tissue in which there is but one small piece of indurated material which shows a firm white focus.

Microscopic sections were taken from the lymph-node removed

from the axilla and the breast tumor. The breast tissue has the typical appearance of a periductal fibroma, the ducts and acini being surrounded by periacinous tissue, and do not show any cystic changes. The epithelium is hyperplastic, as in the previous case and again has the tendency to fill the ducts and acini, and in many areas has broken through its normal limits and has invaded the fibrous stroma in the form of cellular processes somewhat resembling an early form of scirrhus. The lymph-node shows slight hyperplastic changes but no metastatic growth. Pathological diagnosis: Periductal fibroma, beginning carcinoma.

The active state of the breast incident to pregnancy undoubtedly was of great importance in promoting the malignant degeneration in this case. The epithelium of the periductal fibroma, already in a state of instability by reason of proliferative changes aided by the advanced age of the patient, was thus readily transformed into a malignant process. As the tumor was well circumscribed, the lymph-node uninvolved and the carcinoma of an early form, the patient is being carefully observed, a more radical operation not being performed. Without removal of the tumor, and with increasing functional activity of the gland, a form of rapid carcinomatous involvement of the entire breast, such as is frequently seen during pregnancy and lactation, may have developed.

Abnormal Involution.—For the sake of uniformity in following Warren's classification the above term is adopted. The older name, "chronic cystic mastitis," advocated by König, is still used by many writers, and while it suggests to the pathologist the exact condition in the breast, yet by many it has been confounded with acute pyogenic mastitis. König[7] and others believe the disease to be infectious in nature, and by a few it is described as a tumor formation. Recent studies, however, assign the cause to certain abnormalities occurring in the breast during its involution. These changes consist largely in hyperplasia of the epithelium incident to cyst formation, produced in turn by fibrous overgrowth. The tendency toward uniformity in classification of breast disease is gradually being extended to this type in

which heretofore the greatest difference and laxity in nomenclature has existed. Thus we find that Theile [8] in his study concludes that fibro-adenoma, cystosarcoma phyllodes and chronic cystic mastitis form a group of diseases which arise from the same elementary histologic changes, and which are distinguished from one another by a more or less pronounced encapsulation, through the predominating growth of the connective tissue in some and the epithelium in other cases. The original process is to be regarded as neither inflammatory nor as a tumor formation, but as a form of fibro-epithelial degeneration which may manifest itself in one of the tumor formations named. Further evidences of regression are seen in malignant degeneration of the connective tissues into sarcoma, or the epithelial elements into carcinoma. The latter variety is much the more common, although a few instances of sarcomatous transformation have been recorded. Early malignant change as such can probably be recognized by the microscope only, the two varieties producing symptoms which can not be differentiated.

Two varieties of abnormal involution may be distinguished, the cystic and proliferative. The latter class is divided into three subdivisions: (1) Proliferation of the acini, (2) papillary outgrowths of epithelium into cysts, and (3) adenomatous proliferation of epithelium. While the difference of these subgroups is mainly histologic, the degree of epithelial proliferation varies so much that they should be briefly discussed. According to Warren's summary, we find that the first type shows an increase in acini which is accompanied in the majority of instances by a proliferation of the epithelium to such an extent that thickened or even solid columns of cells are produced, retaining, however, the formation of the gland ducts, and presenting no infiltration beyond the basement membrane. While the significance of this form is not determined, it may lead to carcinoma.

In papillary proliferation we find a growth of epithelium in the cyst cavities of such a nature that the cells are heaped up and project into the cavity without a connective tissue

pedicle. The picture suggests that more epithelium is produced in the lining of the cyst walls than can be accommodated on the basement membrane, and is thus thrust into the cyst cavity.

In the third group, adenomatous proliferation is met with, and only in cases in which papillary outgrowths are already present. This form represents a more advanced type of epithelial hyperplasia, and is, therefore, most commonly associated with a carcinomatous degeneration. Nine of Warren's cases were seen in connection with involution changes of the papillary and adenomatous types. Bloodgood [9] has observed more malignant than benign cases of this variety. The five cases of adeno-carcinoma which I have studied showed adenomatous proliferation in each instance. The acinal type of abnormal involution is more likely to degenerate into a scirrhous variety of carcinoma, as occurred in three of Warren's cases, and in one of my series.

Abnormal involution occurs more frequently than any other affection of the breast, with the exception of carcinoma. According to Warren, it constitutes 15 per cent. of all breast diseases, and Bloodgood states that it is seen in 25 per cent. of all benign cases. An analysis which I have made of 180 cases of breast disease shows that it occurred in 18 per cent., and of the 35 cases studied in this laboratory 9 instances of malignancy were encountered (26 per cent.). The following table represents the number of cases of abnormal involution studied by different observers and the number of malignant cases in each series:

	No. of cases	No. carcinoma.
Warren [1]	115	15
Greenough and Hartwell [10]	30	3
Sasse [11]	9	2
Ruloff [12]	11	4
Lichtenbahn [13]	5	0
Theile [8]	19	3
Verga [14]	28	5
Schimmelbusch [15]	43	3
Speese	35	9
Total cases	295	44

Carcinomatous, 15 per cent.

A malignant degeneration in 15 per cent. of the cases represents the general opinion of many observers who have studied this disease. In the cases observed 26 per cent. were found to be malignant, a percentage somewhat higher than other writers. The diagnosis of malignancy depended on the general aspect of the epithelium, the regularity of the acini, penetration of the basement membrane and tendency toward invasion of the stroma. The size of the cells is also to be considered, for irregularities in size and shape is suggestive of carcinoma. The presence of clear, vacuolated cells (*blasse Epithelien*) indicates proliferative changes, as pointed out by Müller and Theile, and when present in abnormal involution, is not diagnostic of carcinoma.

The symptomatology and gross pathologic changes of abnormal involution are so well understood that time will not be taken to describe them. In general, the diagnosis of the condition, especially the diffuse variety, is not difficult. Malignancy is more likely to occur in women past the forty-fifth year of life. In the nine cases reported the youngest patient was 35, the oldest 65, and the average age 47. In many instances the disease had lasted but a few months from the time of observation until operation was performed. In Bloodgood's experience the duration of the disease has been less than four months in cases in which the clinical diagnosis is doubtful. In the adenomatous variety, we find too, that the growth is apt to be more rapid than in the cystic type. In the majority of early cases there are no signs by which a malignant degeneration can be diagnosticated. Enlargement of the axillary lymph-nodes, slight inversion of the nipple, induration of the tumor, pain and tenderness, rapid growth and discharge from the nipple are all symptoms seen in non-malignant cases. The diagnosis of early malignancy will have to be made in the majority of instances at the time of operation, when incision into the suspected area will disclose the carcinomatous tissue.

In doubtful cases exploratory incision is indicated; a careful search throughout the entire part involved is necessary,

for the malignant area is apt to be quite small. Malignancy being detected, a radical operation should be performed. In case of doubt, the entire breast should be amputated, and if the axillary lymph-nodes are enlarged they should be removed. The exploratory incision does not reduce in any way the chance of ultimate cure, whereas exploratory incision followed by the radical operation for malignancy at a later period has been invariably fatal according to Bloodgood. In the majority of cases studied, the carcinomatous area has been small, so that if dependence is placed upon frozen sections made at the time of the operation, great care must be observed to select a suspicious area. As one becomes familiar with the gross changes of this disease, less attention will be paid to frozen sections and the diagnosis will be made from the macroscopic appearance. Malignancy is often so early that careful study of specimens hardened to cut in the usual manner is necessary before the diagnosis can be made. For this reason, I have gradually given up the use of the freezing microtome as a diagnostic aid, and place entire dependance on the naked-eye appearance of the affected tissue.

The bilateral character of the disease is one of its interesting features, and one for which occasionally double amputation has to be performed. Several instances have been observed in which patients have been forced to undergo secondary operations on the opposite breast after having had one amputated for abnormal involution. If indurated areas are present in both breasts, especially in women over forty, a bilateral operation should be performed, and both breasts, or the diseased areas removed. Many of the cases of bilateral carcinoma recorded have in all probability originated in abnormal involution which began as a bilateral affection in both breasts. Case XI of the series supports this view, for in each breast definite carcinomatous nodules were present in association with the changes of abnormal involution.

Certain instances of abnormal involution appear to undergo spontaneous cure, the contents being discharged through the nipple, or the cyst rupturing. More frequently a stationary

stage may be encountered, or the epithelial proliferation advance to malignancy. Cases are encountered which probably represent the initial changes of abnormal involution, definite areas of induration are not palpable, but more or less discomfort is experienced. In this type careful observation may be employed, but in no other form of abnormal involution are temporizing methods to be tolerated, because of the danger of cancer.

Case III.—Mrs. M. S., aged 55, service of Dr. Edward Martin. Mother of several children, no previous breast disease. Two years ago the patient received a severe blow on the left breast which has been painful since the accident. About six weeks ago a small nodule was noticed in the breast. There was slight pain and tenderness, the skin and nipple normal, and on palpation the tumor was hard, not larger than a hazel nut and adherent to the surrounding tissues. The axillary nodes were not palpably enlarged.

Specimen (2497) is a breast with underlying muscles and axillary tissues. On section a hard nodule about 1½ cm. in diameter is found which shows a fine yellow mottling at the centre surrounded by a translucent greyish tissue which sends off fine fibrous processes into the surrounding tissue, and by contracting cause a puckered appearance at this point. Throughout the process there is considerable greyish parenchyma which seems increased and more fibrous than normal, but nevertheless there are no frank characteristics of malignancy except at the one point first noted. The nodes in the axilla are very slightly enlarged, soft, and grossly do not suggest metastasis.

Microscopically the breast tissue near the growth is very fibrous in appearance and contains numerous small cysts. The glandular acini are slightly increased in number and are so compressed by the fibrous tissue that they resemble the cellular processes of a scirrhus. In some areas a moderate hyperplasia of the epithelium has occurred in the acini. While the abnormal involution here seems to be of the cystic type, slight hyperplasia is present. Numerous sections do not reveal a process which can be regarded as predisposing to cancer. That this must have occurred somewhere in the process of abnormal involution is shown in the sections taken from the dense nodule, where the compressed epithelium is seen surrounded by a dense fibrous stroma—the picture being a typical scirrhus.

Diagnosis: Abnormal involution (acinal type). Scirrhous carcinoma.

Case IV.—Mrs. M. M., aged 44, service of Dr. J. W. White. About one year ago the patient noticed that the left breast was somewhat larger than the right. One month ago she received an injury of this breast, and noted then for the first time that several hard nodules were present. Since then she has had pain and the tumors have increased slightly in size. She has had two children, but did not nurse either one. The nipple and skin are both normal, and the nodules do not seem adherent to the surrounding parts.

The specimen (2237) obtained by the operation consists of two portions of breast tissue measuring about 14 x 6 cm. Two distinct processes are seen in the breast, the first a rather diffuse infiltration of dense, glistening, whitish tissue in which a few cysts about the size of a pea are present. This process is not very marked, and extends through a small portion of the breast. The second process consists of a soft pinkish mass of tissue about the size of a hen's egg which shows softening and degeneration in its centre. Section through the latter demonstrates a dense mass which is adherent to the surrounding breast tissue.

Microscopic examination of the first process shows marked increase in the number of acini, in which the epithelium is slightly proliferated. The stroma is dense and contains but few cells. Cyst formation is inconspicuous and proliferative change, beyond that noted, is not present.

The soft tumor mass reveals evidence of extensive leucocytic reaction which in some places obscures the tumor tissue. The latter is seen as collections of large and slightly irregular epithelial cells occurring in masses and showing mitosis. The inflammatory reaction which extends to the surrounding tissues, was probably caused by the injury received.

Diagnosis: Abnormal involution (Acinal type). Carcinoma.

Case V.—Mrs. M. O., aged 46, service of Dr. Edward Martin. Patient received a blow over the left breast 17 years ago. Shortly afterward she noted a lump in the breast which did not enlarge until four months ago when it began to increase

in size and became painful. There was no discharge from the nipple, the tumor was freely movable and the axillary nodes uninvolved. The breast was removed, the pectoral muscles and the axilla were not disturbed.

The specimen (2501) showed a fibrous and cystic process which was diffuse in character. Microscopically the sections taken from different portions of the breast reveal in most places a typical appearance of abnormal involution with great production of fibrous tissue compressing the ducts, in some places giving rise to small cysts. The epithelium of the acini is hyperplastic and the basement membranes often poorly defined. In a few places the proliferation is so great and its appearance so atypical that it is impossible to interpret the processes as simply due to pressure from overgrowth of fibrous tissue. Several large masses of cells which show mitotic figures and of invasive tendency are seen. In addition to these changes in the acini other areas show papillary proliferation in the cysts; the epithelium here is quite different in appearance from that of the tubules and cysts seen elsewhere. The cells are larger, the protoplasm is pale and has a vacuolated appearance. The nuclei are small and are deeply stained. In general the epithelial growth is toward the lumen, and the basement membrane is well defined. Occasionally the arrangement is lost and the appearance is that of an epithelial invasion.

The process is regarded as malignant, and certainly suggests the multicentric origin of carcinoma in this instance, for the cancer although early, is apparently arising in two different ways: (1) secondary to acinal proliferation, and, (2) as the result of papillary proliferation.

Diagnosis: Abnormal involution (acinal and papillary types). Carcinoma.

Case VI.—Mrs. F. M., aged 45, service of Dr. J. W. White. About one year ago noticed a small nodule at upper margin of left breast, and a few weeks later a second one in the axilla. At that time both nodules were freely movable and not painful, but later grew rapidly. About ten months later the nodule in the breast was removed and sent to this surgical laboratory and reported as carcinomatous. A few months later she entered the hospital because of the formation of other tumors in the breast, and in the axilla. At this time the mass in the breast

was firmly adherent to the surrounding tissues, the nipple and skin were retracted.

The specimen (2030) consists of an amputated breast, the elliptical section of skin measuring approximately 12 x 4 cm. in length and breadth. The nipple is not retracted, but at the opposite extremity of this elliptical section of skin there is an old scar about 1 inch long running at right angles with the long axis of the skin section. Palpation over this scar reveals the presence of a mass buried beneath the skin and superficial fascia. Incision through the pectoral muscles and fascia on the inferior aspect of the breast displays a mass about 1½ inches in diameter and of a dirty, grayish brownish coloration surrounded by a mass of white fibrous connective tissue. Incision through the tumor itself displays surfaces of a mottled, reddish and grayish coloration, the red areas being quite friable.

Microscopically the tissue in the involuting portion of the breast is very fibrous, and contains a few small cysts. In these papillæ are seen, and in others the epithelium is atrophic from pressure. The tendency toward adenomatous formation is not marked. The carcinoma appears as a dense collection of cells in which necrosis is present (medullary form) and as atypically developed acini (adenocarcinoma).

Diagnosis: Abnormal involution (proliferative form). Medullary and adenocarcinoma.

Case VII.—Service of Dr. J. B. Carnett. Patient aged 43 years, single, has had several operations on the right breast, two cysts being removed, the tissue, however, not being examined microscopically. For several months she has suffered with pain in left breast, which on examination contained three distinct cysts, one to the inner side of the nipple, and one each in the upper and lower outer quadrants of the breast. The tumors were freely movable, the lymph-nodes not enlarged, the skin not involved. Operation: plastic resection, all glandular tissue being removed because of the extensive involvement.

The specimen (1589) consists of two masses of tissue, one about the size of an egg, the other the size of the palm of the hand. Both have the same characteristics, and contain many cysts which vary from a pea to a hazel nut in size. The tissue on section is dense in quality, fibrous, and cuts with some difficulty.

Microscopically many small cysts containing papillæ are present, the lumen of some is filled with a homogeneous secretion and desquamated epithelium. The lining cells are cuboidal in shape, the acini are increased in number and many of them are filled with cells some of which are cuboidal and others cylindrical. The epithelial hyperplasia also occurs in the form of rather cellular collections in which a few atypical acini can be distinguished. They are found in the fibrous stroma, unlimited by a basement membrane and infiltrating the tissues.

Diagnosis: Abnormal involution (acinal and papillary proliferation) Adenocarcinoma.

Case VIII.—M. C., aged 65, service of Dr. J. H. Jopson, Presbyterian Hospital. About 10 years ago patient had the right breast amputated for carcinoma. There has been no recurrence of trouble since the operation until four months ago when she noted a lump in the upper and outer quadrant of the left breast. On palpation this was found to be tender, rather diffuse in character and freely movable. In the axilla several enlarged lymph nodes were present which seemed to be adherent to the surrounding structure. A clinical diagnosis was made of carcinoma secondary to abnormal involution, and the breast amputated.

The breast (1963) was found to be the seat of a diffuse fibrous and cystic overgrowth, and in one area a dense mass the size of a walnut was detected. The axillary nodes were hard, and of the same character as the small tumor in the breast.

Microscopically the usual picture of abnormal involution is seen, papillary and adenomatous proliferation of the epithelium is present, the papillæ almost filling some of the cyst cavities In the immediate vicinity of the cyst, the cells have infiltrated the tissues forming carcinomatous masses in which there is an attempt to form acini. The cells in these areas are irregular in size and shape and show many mitotic figures. In the stroma leucocytic infiltration is marked.

This patient developed local recurrence and died three years later. The autopsy showed a single carcinomatous nodule in the liver, pathological fracture of the femur due to metastasis and skin metastases.

Diagnosis: Abnormal involution (papillary and adenomatous type). Adenocarcinoma.

Case IX.—Mrs. J. G., aged 55, service of Dr. Edward Martin. The patient was admitted for removal of a growth in the right breast. This on examination was in the outer quadrant, was dense in character, the skin and nipple were not adherent, the axillary lymphatics were uninvoluted. The breast was amputated, and on careful inspection did not show any gross evidences of cancer. The process present (2434) was diffuse and fibrous in nature, pinkish-white in color, and contained numerous thin-walled cysts whose contents were clear. The cyst walls were smooth and did not reveal any papillary growths.

Microscopic examination shows a marked overgrowth of the connective tissue, the nuclei being abundant showing an active proliferating process. Along with the connective tissue changes there is a considerable hyperplasia of the glandular acini which are present in great numbers. The epithelium is in an active state of proliferation; fills many of the acini, some of which are dilated. Small papillæ project into the cysts which are quite small. In the adenomatous parts some of the acini are quite irregular in shape and are closely packed together; toward the periphery of the areas the acini have no regular basement membrane. The cells are without definite arrangement in the connective tissues in some places, in others the form of acini is assumed. The epithelial cells do not show marked deviation from the normal type, although some irregularity in their size is present. About the adenomatous areas the tissues are invaded by leucocytes, and the stroma here is more cellular than elsewhere.

Diagnosis: Abnormal involution (adenomatous type). Adenocarcinoma.

Case X.—Mrs. J., aged 40, service of Dr. A. C. Wood. One year ago she had a small tumor removed from the right breast which on examination proved to be carcinomatous in nature. Immediate amputation of the breast was advised but refused. In a short time the growth reappeared, and X-ray treatment was begun. This was continued for a year, 80 treatments being given; the tumor, however, increased, so that surgical interference was again sought.

The breast was amputated, and on opening the axilla enlarged lymph-nodes were not found.

The specimen consists of a breast with some axillary lymphoid tissue. To the breast is attached the pectoral muscle and a

large amount of fat. The skin with nipple attached does not shown any abnormal changes or retraction. Cross section through the breast shows a rather diffuse whitish infiltration which resembles the fibrous tissue changes following involution. A few small cysts are present which contain a clear secretion. At one corner of the breast directly above the pectoral muscle but not attached to it, is a nodule not larger than a pea, which is hard, indurating in character and infiltrates the breast tissue. This is the only macroscopical evidence of malignant disease which is present. The fatty tissue removed from the axilla is perfectly normal in appearance.

The sections were taken from the tumor and the fibrous tissue. In the latter the process is benign and consists of a marked fibrous overgrowth in which a few cysts appear. The acini are increased in number and in a few as well as in some of the ducts, the epithelium is proliferating, and appears as minute papillæ. The cells of these papillæ are slightly irregular in shape, and in many of them the protoplasm is quite clear. The nuclei are deeply stained and regular in size. There is no attempt in these areas for the cells to break through the basement membrane of the glands. In the stroma a round cell reaction is present.

The sections taken from the tumor show a well-advanced carcinoma which is embedded in a dense fibrous stroma. The tumor cells form rather dense masses and have undergone necrosis in many places, probably the result of the X-ray treatment. A connection between the benign disease and the carcinoma is not seen microscopically. The lymphatic tissue is normal.

Diagnosis: Abnormal involution (acinal type). Carcinoma.

Case XI.—B. W., aged 35, service of Dr. C. H. Frazier. Has had three children but no previous breast disease. About two years ago she noticed small lumps in each breast, the growth of which have been gradual, have caused pain and have given the patient considerable anxiety. On examination, the nodules are about the size of a hazel nut and freely movable. The axillary lymphatics are uninvolved. As an abdominal operation had to be performed, it was thought advisable to remove the breasts.

On examination both breasts show practically the same characteristics, being the seat of a diffuse fibrous overgrowth in

which numerous small shot-like cysts appear. This tissue while firm is not dense in quality and contains embedded in it several small pinkish white nodules which are adherent to the fibrous stroma. These nodules are hard and dense when compared with the other process and cut with great difficulty. In the left breast, one of the nodules slightly infiltrates the pectoral muscle which is attached to the breast.

Microscopic examination of the stroma shows a slight fibrous overgrowth of the periacinal tissues, which is quite cellular. Numerous dilatations of the ducts and acini are present and in these the epithelium is heaped up in masses and in the form of papillæ. There is no evidence of malignancy until the sections taken from the small nodules are examined, when a marked cellular hyperplasia is encountered. The stroma is relatively slight in amount—the acini and ducts filled with cells and papillary formations. In the stroma, the acini are arranged in an irregular manner and much epithelium is present in small ill-defined masses. The carcinoma in the left breast is more advanced in type than that of the right.

In this case a malignant degeneration had arisen without causing any marked symptoms.

Diagnosis: Bilateral abnormal involution (adenomatous proliferation). Bilateral adenocarcinoma.

Cystadenoma.—The epithelial type of the fibro-epithelial group of tumors is less important than the fibrous variety from the standpoint of frequency, occurring in only 2 per cent. of the cases. Warren subdivides this group into fibro-cystadenoma, and papillary cystadenoma.

The fibrocystadenomas are regarded as an exaggeration of the periductal fibroma from which they differ by the secondary proliferation of the epithelium. The tumors occur in young single women, are of slow growth, of long duration and are generally painless. While the prognosis is favorable in this class, the degree of epithelial hyperplasia makes a carcinomatous degeneration likely, so that removal of the tumor should always be practised.

In the papillary cystadenoma we have a more common and at the same time more dangerous affection. Clinically

we have to deal with a tumor formation seen in advanced life and especially in women who have borne children. As in the first variety, the tumor is slow in growth, of long duration, and is usually situated near the nipple, from which a bloody discharge occurs in the majority of cases. While they rarely attain large size, and are almost always slow in growth, such complications may arise and make the diagnosis of a malignant degeneration most difficult. The following case occurring in Dr. Frazier's service illustrates this fact.

Case XII.—Surgical pathology (2562). The patient is single, 22 years of age, and has always been perfectly well with the exception of her breast condition. This began eight years ago when she noted a small lump in the right breast, which followed a blow received a short time previously. The tumor was painless and showed no tendency to grow until 18 months ago, when enlargement and pain began. This has continued until the growth is as large as a child's head and causes discomfort from its weight. The mass involves the entire breast, is not adherent to the underlying structures, and the skin is freely movable except at one point near the nipple. Several soft cystic spaces which are surrounded by dense tumor tissue are noted. There has been no discharge from the nipple, several axillary nodes are palpable. The case was regarded as malignant from the history and the entire breast and axillary lymphatics removed.

The specimen on examination shows an encapsulated mass which is neither adherent to the skin or the pectoral fascia beneath. Near the nipple a round reddish encapsulated tumor about the size of an egg is present. From the base of the fibrous capsule many fine papillæ project and almost fill the cavity. This tumor is distinct from the mass which occupies the remaining portion of the breast, which presents a dense white appearance, and is divided by numerous septa into small nodular masses. The tissue is unyielding and fibrous and in a few places only shows a tendency toward papillary formation, as in the smaller growth first described.

Microscopically two distinct processes appear to be present in the breast. Sections from the dense tissue show a process resembling periductal fibroma. Here the stroma is very cellular, indicating an active proliferative process, and surrounds the

ducts and acini. In the latter the epithelium is in a state of hyperplasia, forms a lining composed of several layers, has filled the lumen in a few acini and in others lines delicate papillæ. The cells are cuboidal in shape, regular in outline and some have the pale translucent appearance seen in proliferating epithelium. In the small tumor a similar fibro-epithelial hyperplasia is apparent, but in this case the epithelium is even more active, and papillary formation marked. The cystic spaces here are in places almost filled with papillary overgrowth, but careful examination of many slides does not show any malignant tendency in spite of the general proliferative change. The axillary nodes were not involved in a metastatic growth, but were hyperplastic.

The process is a cystadenoma in which the papillary character is seen in the small growth, the fibrous form predominates in the remaining portion of the breast.

From the very rapid growth of this tumor, its size, long duration and pain, a malignant degeneration was suspected. The degree of hyperplasia of both epithelial and connective tissues proves that such a process was imminent, and that the tumor was probably removed prior to such a transformation.

When malignancy is about to develop in such tumors, they apparently undergo a variety of changes and degeneration. Gassert [19] reports a case of cystadenoma and carcinoma in which he found areas resembling the lactating breast, simple cystic dilatation, adenomatous formation with cystic degeneration, papillary proliferation and finally carcinoma. He believes that the adenomatous proliferation and the cysts were independent.

The difficulty in differentiating malignancy in early cases of this disease is emphasized by a comparison of the rapidly growing benign tumor just reported with the following instance of malignancy, in which the size, clinical history and pathologic findings of the case differ materially.

Case XIII.—Surgical pathology (1425), service of Dr. Edward Martin. Mrs. S., aged 35, married, mother of several children. No previous breast disease. A few weeks ago she noted a small tumor in the right breast which was painless,

originated without any cause so far as could be ascertained, and was freely movable. The tumor was not adherent to the skin, there was no discharge from the nipple which was slightly inverted.

On opening the cyst which was about the size of a walnut, a bloody fluid escaped. The lining was smooth except at one point where a small papillomatous nodule, red in color projected.

Sections for microscopic examination were taken from the small papilloma and the portion of the cyst wall from which it grew. The epithelium lining the papillary projection is very irregular, appearing in one or more layers of cells which are very irregular in their shape. In other areas the papillæ have fused so that a dense collection of cells appears. In the stroma irregular acini are seen, the cells here present irregularities and do not completely surround the lumen, occasionally all attempt toward glandular formation is lost and cellular masses lie in the tissues without a limitating membrane. Some of these cellular collections containing atypical acini are found in the fatty tissue of the breast directly outside the cyst wall, and indicate that the process is extending to the surrounding parts.

Diagnosis: Papillary cystadenoma; adenocarcinoma.

A radical operation was refused in this case. Eighteen months later the patient was found to be free from any breast disorder.

The cystadenoma have been studied carefully by many pathologists and especially with the object of determining the probability of a malignant degeneration. Greenough and Simmons [20] found adenocarcinoma associated in 15 per cent. of twenty cases. The cancer appeared to be associated with the existence of the papillary tumor, and the type was the same in all three instances. Reliable symptoms of early malignant degeneration are wanting, for we find that the malignant papillarycystadenoma occasionally is of long duration, and may be seen at a fairly early age. The diagnosis must therefore be made at the operation, when inspection of the cyst and the surrounding tissues will reveal any infiltration. In certain cases of malignant papillomatous cysts which Bloodgood has observed, the diagnosis could be made clinically from the

history of long duration of the tumor, discharge of blood from the nipple with retraction of the same and skin involvement. Such breasts revealed a pathologic picture entirely different from benign cysts; instead of a papilloma in the wall there was a soft fungus growth resembling a medullary carcinoma. In diagnosing these cases much emphasis should be laid upon the character of the cyst contents as well as in cancer cysts to be considered later.

Cancer Cysts.—By this term is meant a malignant transformation in the wall of a benign cyst, a class of cases distinct from the cystadenomata, and the cystic changes seen in abnormal involution. While the origin of the cancerous degeneration is not quite clear, the retrogressive changes which the epithelium undergoes can be regarded as responsible. The lining cells of the cyst become compressed or atrophied, and in addition retrograde changes in the fibrous wall may occur, these factors playing a more or less important rôle in the degeneration which may follow. The origin of the cancer is not so important when once the disease is well established, for then a radical operation is indicated. The diagnosis in early cases, from the purely clinical stand-point, presents the same difficulty as is encountered in other instances of malignancy secondary to benign affections—reliable evidences of the metamorphosis are wanting. Here again the exploratory incision and examination of the cyst must be our method of diagnosis. Bloodgood [21] states that this depends upon the contents of the cyst, if bloody and a benign papilloma is not present, a cancer should be suspected. Granular or grumous material in the cyst should lead to the diagnosis of cancer of the cyst wall. Palpation will also be of great value in detecting the presence of small carcinomatous nodules, or diffuse infiltration of the wall. In certain instances the wall becomes rough or reticulated, which in the presence of hæmorrhagic contents, as in a case I have recorded elsewhere,[22] should lead to the diagnosis of cancer. In the cancer cysts in particular, Bloodgood emphasizes the greater certainty in diagnosis from the gross appearance than from rapidly frozen sections.

Mastitis.—The relationship between inflammatory affections of the breast and the development of carcinoma at a later period has been recognized for many years. Two types of mastitis are important in connection with carcinoma; in the first the inflammation is associated with a very rapid and malignant growth of the tumor, so that the entire breast becomes involved. This form is uncommon, is most frequently seen during pregnancy or lactation, which states seem to hasten the process. Volkmann has given the name "carcinomatous mastitis" to this disease; by others it has been termed "acute carcinoma."

By far the more important group of infections coming under the scope of this paper are encountered in the inflammations which occur as complications of lactation, the tissue changes resulting act as the predisposing factor in the development of cancer. A similar effect is seen in the granulation tissue caused by the healing of wounds, or hæmatomata following traumatism. The scar thus formed does not possess the resistive power of normal tissue, and constitutes a locus minoris resistentiæ. Chronic irritation then occurring in an individual whose vitality is diminished by old age may cause proliferative changes in the epithelium, which growing deeper and deeper into the breast finally become malignant and appears as a carcinoma. Guleke [16] believes that the epithelium which undergoes such proliferation arises from ducts and acini which are cut off by the contracting scar tissue.

The presence of points of induration or distinct nodules as after effects of inflammation or traumatism, and the many clinical reports of carcinomatous formation in direct relationship with such areas, indicate clearly that we have to deal with a condition which may be more common than suspected. While statistics cannot be relied upon to furnish us with absolute proof of the occurrence of mastitis previous to the development of cancer, yet the reports published indicate that such inflammation has existed in 10 to 20 per cent. of the cases. The time elapsing from the inflammation until malignant metamorphosis ensues varies from several weeks to many

years, in advanced cases 20 to 30 years may elapse before severe pain and rapid enlargement indicate that carcinoma may be developing. Such symptoms, on the other hand, are not always present, for Steinthal [17] records an instance in which a small carcinoma was accidentally found in a mass of chronic inflammatory tissue. Many cases of carcinoma are seen in which a previous mastitis has not caused changes in the breast recognizable by palpation. Whether the malignant degeneration here is independent of the previous inflammation or not, is difficult to determine. Scheurer [18] believes that although an apparent restoration to the normal state has occurred, yet certain minute changes are present, which remaining latent for years, finally through some unknown irritation, manifest themselves as a malignant tumor.

From a practical stand-point, the question can be raised whether we are justified in permitting areas of induration to remain, especially if the patient is near the menopause. Certainly in view of the possibility of cancer, such cases should receive as careful attention as other forms of benign disease, early removal of which may prevent cancer and its greater danger.

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DR. WILLIAM L. RODMAN said that it is beginning to be appreciated that all benign tumors in every part of the body are liable to malignant degeneration, and that this is more likely to occur in the breast than elsewhere, on account of the fact that the soil of the mammary gland is fertile to cancer. He did not, however, think it to be appreciated as sufficiently as it ought to be that the danger of any benign tumor undergoing malignant change sooner or later, is as great as it is; as Dr. Speese had said. there are certain varieties of neoplasms more prone to undergo carcinomatous change than others. The papillary cyst adenoma he should consider the most likely to undergo malignant change. In the first place it is with difficulty differentiated from malignant disease; so is involution mastitis. Papillary cyst adenoma is, however, more likely to involve the central part of the gland and to be just behind the areola; whereas involution mastitis particularly is more likely to involve the periphery of the gland. There would be more difficulty in differentiating between papillary cyst adenoma and involution mastitis than between papillary cyst adenoma and carcinoma. The age of the patient is also a help. Papillary cyst adenoma is usually more apt to occur about 50, and there is very little pain, whereas there is much pain in involution mastitis. There is, however, such a similarity regarding age in these various conditions, that the only safe way of making a diagnosis is by an exploratory incision, which should only be done after the consent of the patient has been obtained for a complete operation should one be deemed necessary. He had always believed a great deal in the value of macroscopic appearances, still he would take issue with Dr. Speese, in that he did not think the macroscopic appearance can possibly be of as great value as

the frozen section. He would not depend entirely upon a frozen section, but he did think them practically safe and reliable and never operates a suspicious case without the presence of a competent pathologist and his freezing microtome. This plan he had followed for 17 years and had known but two mistakes made in diagnosis by depending upon frozen sections. Very recently some of the most prominent members of the Philadelphia Pathological Society materially differed concerning the nature of a breast he removed at the Presbyterian Hospital. Some thought it sarcoma, others carcinoma, and others still that parts were carcinomatous and parts sarcomatous. These examinations were not made quickly and after frozen sections but weeks and months after the breast was removed. It was referred to a committee for final report. If such differences occur after the better and more accurate way of interpreting the microscope, of course it can, and will occasionally occur when frozen sections are relied upon.

DR. GEORGE G. ROSS said that he would not belittle frozen sections, but they are usually made with great haste, the selection of the portion is not always a careful one, and there is great possibility for error. If a portion of the most suspicious part of the tumor were always selected, and if the section were always well stained, these reports would be of much greater value. He believed, however, that the macroscopic appearance, particularly to a man who has had experience, is a better guide in deciding at the operating table. The ideal time for operating on carcinoma is before it really exists.

DR. GEORGE P. MÜLLER said that he did not believe malignancy as a rule occurs in fibroma; in those cases where it does develop he believed it to be accidental or else to be one of the fibrous forms of cystic adenoma, because the tissues are so compressed that the epithelium is practically atrophic and incapable of malignant reversion. With regard to enlargement of breast tumors in pregnancy one should be careful not to attach too much importance to rapid growth during this period. As to the age of the patient, he would take exception to the common statement that 45 is the age at which cancer appears, or that 40 is the age at which the diffused cystic hyperplasia is most apt to be seen. Every one has seen cases of cancer under thirty, and age should have nothing to do with the diagnosis in the individual case.

As to the use of the frozen section he agreed with Dr. Speese; he had used it for many years and had come to distrust his own judgment in the matter. He believed with Speese and Bloodgood that the frozen section had not the value that many surgeons attach to it and that more attention should be paid to the naked eye appearance of the growth.

The plastic operation of Warren should be adopted with great caution, and only used in cases of abnormal involution of the cystic type.

LEUKÆMIA RESEMBLING PYONEPHROSIS.

Dr. Francis T. Stewart reported the case of a man aged 47 years, who was admitted to the Jefferson Hospital July 23, 1909, for pyonephrosis which had ruptured into the bowel.

The trouble began 16 years ago after an attack of typhoid fever, when he began to complain of dull pain in the left loin. The pain was associated with a swelling in this region which disappeared with the cessation of the pain. The pain and tumor have come and gone a number of times, sometimes suddenly but more often gradually. They have occurred as often as once a month and have sometimes remained absent for as long as four months. The pain is usually dull and aching in character but occasionally severe and lancinating and sometimes referred to the left testicle. The last severe attack occurred in May, 1909. There was intense and agonizing pain, with fever, sweating, vomiting, and headache. The urinary output was lessened during the attack but towards its end became whitish, profuse, and finally red and fetid. About four days after the onset of this paroxysm he was suddenly relieved of his pain and shortly afterwards passed a large quantity of sanguineous pus by the bowel. Since this time the bowel movements have always contained some pus and blood.

The patient is tall and thin and has lost much weight. The skin is pale and dry and the mucous membrane anæmic. There are many enlarged lymphatic glands in the posterior cervical triangles, both axillæ, and both groins, the largest measuring about 2.5 cm. in diameter. They are painless and freely movable. The thoracic organs are normal.

The abdomen is symmetrical in contour, soft, and not painful. There is an indefinite resistance in the left flank but no rigidity

or demonstrable mass. The liver and spleen are apparently normal.

Blood examination: Hæmoglobin 80 per cent., red cells 6,000,000, color index .6, leucocytes 9200. The feces showed blood and pus but no free fat. Rosenberger's test for tubercle bacilli negative. On cystoscopic examination the bladder and ureteral orifices showed no pathological change. A catheter was passed up each ureter to the kidney without meeting with any obstructions. The left kidney secreted 8 c.c. while the right secreted 75 c.c. of urine. The urine from each side was practically identical and showed no abnormality except a few red blood cells; no tubercle bacilli could be found. Methylene blue appeared in the urine from the right kidney in one hour and in the left in one hour and fifteen minutes after being swallowed. No methylene blue appeared in the stools although some of the drug was injected directly into the pelvis of the left kidney. An X-ray examination of both kidneys and ureters showed no stone.

Having improved somewhat while in the hospital the patient decided to leave and to return if the improvement did not continue. In September he was readmitted to the hospital; he had lost more weight and the pain had returned. Upon reinvestigation the spleen could be palpated, and extended from the seventh rib to within two fingerbreadths of the iliac crest. The urine was normal except for a slight trace of albumin. The blood showed: hæmoglobin 65 per cent., red cells 4,300,000, white cells 56,000, color index .7. A differential count of the leucocytes showed polymorphonuclears 6 per cent., lymphocytes 81 per cent., hyaline 7 per cent., degenerated 6 per cent. Later the lymphocytes ascended to 89 per cent. Proctoscopic examination revealed a few small ulcers and numerous polypi, the largest of which was one and a quarter inches in diameter; they were pale, firm and slightly tender. On the 28th of September the temperature rose to 101 and the pain in the loin was severe; during the night the temperature fell to normal, the pain almost wholly subsided, and there was a profuse discharge of pus and blood from the bowel. The following day the spleen could not be palpated.

In this case, in the opinion of Dr. Stewart, the pain and swelling in the left loin are due to engorgement of the spleen, which shrinks as the result of a free hemorrhage into the bowel, a not uncommon complication in leukæmia. The pus in the feces

comes from the ulcers and polyps in the rectum and colon; perhaps the latter are leukæmic tumors.

SARCOMA OF THE PSOAS MUSCLE TREATED BY EXCISION, X-RAY AND COLEY'S FLUID.

Dr. Stewart also reported the history of a man, R. G., 27 years of age, who was admitted to the Jefferson Hospital September 12, 1908. In December, 1907, while lifting a heavy stone he felt a sharp pain in the right iliac region, but this subsided after a time and left a dull ache. About four months later he noticed a swelling in the lower right abdomen; this increased in size and finally filled the iliac fossa, almost reaching the median line. It was very firm on palpation but could not be demonstrated with X-ray. It was smooth, and moderately tender, and was intimately attached to the iliac bone. When the thigh was extended there was an audible click in the hip-joint. On September 15, 1908, an incision was made along the iliac crest and Poupart's ligament, severing the muscles of the abdominal wall. The peritoneum was then displaced inwards, the iliac vessels, which skirted the inner side of the growth, retracted towards the median line, and the tumor, together with the iliopsoas muscle, from which it sprang, excised. It was necessary to sever Poupart's ligament in order to cut the muscle close to the femur. The growth had infiltrated the inner table of the ilium over an area about 3 inches in diameter. The bone in this region was removed with a curette and the bleeding checked with Horsley's wax. The wound was sutured except at its upper end, which was left open for the exit of a gauze drain. On microscopic examination the tumor proved to be a round-celled sarcoma. About a month after operation a diffuse swelling could be felt beneath the scar and this was thought to be a recurrence. A sinus still existed at the point where the drain had been placed but there were no evidences of retention of pus or of inflammation. The patient was given X-ray treatment every second day. Two months after operation the skin in the region of the wound became red and tender and the patient was forced to his bed because of fever and weakness. This area of inflammation, probably erysipelas, extended down over the gluteal region and upper third of the thigh. The sinus was still open. The fever lasted about 10 days and disappeared with the subsidence of the inflammation. The swelling in the

right abdomen slowly increased in size until the advent of the erysipelatous inflammation, after which it seemed to remain stationary. On February 25, 1909, the subcutaneous administration of Coley's fluid was begun, but no reaction could be obtained, although the dose was run up to 7 drops. On March 3 a new fluid was obtained, 3 drops of which gave a decided reaction. These injections were continued up until March 25, the maximum dose being 8 drops. A second febrile reaction was not obtained. During the administration of Coley's fluid the growth began to shrink, finally disappearing sometime in May, 1909. The X-ray treatment was continued throughout the treatment, and is still given at intervals to guard against recurrence. The patient has gained 40 pounds in weight.

Dr. George P. Müller said with regard to the first case, that he saw one of a similar nature some 8 or 9 years ago when a resident in the German Hospital. A woman of about 35 was admitted to Dr. Deaver's service with a history of having been delivered of a child; six weeks previously she had fever and chills and was thought to have an infected uterus. A blood count made as a matter of routine showed 100,000 leucocytes, and a diagnosis of acute lymphatic leukæmia was easily made.

With regard to Dr. Stewart's second case, he recalled a patient, 28 years old, admitted to Dr. Frazier's wards in the University Hospital, upon whom he operated for a large lymphosarcoma of the neck; this was dissected out and in a month there was a recurrence along the trapezius which was also removed. The patient was then treated with Coley's toxin and is well at the present time and free from recurrence, one year after operation. He had had other cases treated with Coley's toxin with entire failure

Dr. John H. Gibbon said that he saw both the cases reported by Dr. Stewart. In the first without the blood count one might easily have made the mistake of operating.

The second case reported is the second case he had seen with an apparent cure after the use of Coley's toxin. He had used Coley's toxins religiously in inoperable sarcoma, and even in cases where he thought he had removed the growth. The other case is that of a young girl 16 or 17 years of age upon whom he operated at the Jefferson Hospital in February, 1908, removing an osteosarcoma of the humerus. He wanted to do a shoulder-joint amputation, and explained the situation to the family, but

they would not consent, although the girl herself was anxious to have it done. He then started her out on Coley's toxins and also gave her X-ray treatment which Dr. Manges carried out persistently. He did not remember just how long it has been since the operation, but about 18 months, and she is now apparently perfectly well. These are the only two cases in which the combination of the X-rays and Coley's toxins have in his experience worked an apparent cure, although he had combined this treatment in practically all of his cases. This case reported by Dr Stewart was 27 years of age, Dr. Müller's patient 28, and his own case under twenty, so there are three cases under thirty and he thought we should therefore continue to use these two remedies in even what appear to be hopeless cases.

Dr. John B. Shober added one case of sarcoma occurring in a young married woman, cured by means of operation and treatment by the X-ray without Coley's toxin. The patient was 27 years of age. Upon operation upon a growth in the forearm he found a cystic spindle-celled sarcoma developing from the interosseous tissue. By an extensive operation he thought he had removed the entire growth, including the cyst wall, but after a few months there was recurrence of the tumor. He then urged operation which she declined. She subsequently fell into the hands of Dr. Pfahler, who treated her with the X-rays and he sent her to see him some years later entirely cured.

His limited experience with Coley's serum in these cases has been disappointing. He would prefer in the future to rely upon first operation and then the use of strong radium bromide, the X-rays, or both.

Dr. William L. Rodman said there is one point in connection with this case, and that is if it does prove to be a radical cure it will be most interesting, insomuch as it was a round-celled sarcoma, which is the least favorable variety for the toxin, as pointed out by Coley himself. Personally he had been using Coley's toxin since 1894 and had seen a decided improvement in many cases but was sorry to say he had not seen a cure in any cases. He had seen several cases cured by the X-rays alone. He had no faith in the treatment of carcinoma by the X-rays as he thought on the whole, more harm than good had resulted from such treatment. Only superficial epitheliomata are cured by X-ray treatment. It is very different with sarcoma. In all inoperable sarcomata Coley's toxins and the X-rays should be used conjointly as both are often helpful and sometimes curative. He had seen several of Coley's cured cases and a colleague in Louisville, Dr. M. F. Corrum, at his suggestion, used the toxins successfully 13 years ago in a very advanced sarcoma of the throat.

Dr. Francis T. Stewart (in closing) said he had used Coley's toxin in all inoperable cases of sarcoma and in most, if not all, cases of sarcoma after operation, but this was the first time he had had any encouragement. Whether this improvement is due to the Coley's toxin, the X-ray, or the erysipelatous infection, or whether it is due to some other condition of an obscure nature, he did not know.