charged on 48th day. Patient writes Jan. 23, 1914, wound healed completely three weeks after going home. General health excellent. No disabilities.

CASE 5. Ileostomy; recovery. N. L., male, aged 9, patient of Dr. Duggan, Milford, Mass. Operation May 5, 1916, at Milford Hospital; removal of a gangrenous appendix lying in a localized abscess to the the outer side of caecum close to the abdominal wall; drainage. Convalescence unsatisfactory from the beginning with tendency to distention, occasional vomiting and abdominal pain. Enemata at first gave partial relief, but distention gradually increased, the vomiting became more persistent and faeculent in character. On the eighth day, enterostomy through the original incision by another surgeon. This resulted in a moderate amount of faecal discharge and slight improvement in general condition for a few hours. The distention and vomiting persisted, however, and the child's condition became desperate. On the tenth day ileostomy through an incision through the inner border of the right rectus muscle. The abdomen was free from adhesions except in the region of the original wound. Glass tube tied in distended loop of bowel running toward these adhesions. The vomiting and distention were relieved. Three days following operation, there was a free movement by rectum. Movements by rectum continued, the discharge through the two enterostomies, at first large in amount, gradually diminished, and he was discharged on the forty-first day following the original operation, the enterostomies practically closed. His father writes, December 7, 1919, that the boy is well except for nervousness, the wounds have remained healed and he has no pain.

CASE 6. Ileostomy; recovery. V. M., girl, aged 8, patient of Dr. Joslin, Milford, Mass. Appendectomy with drainage for acute appendicitis by another surgeon February 1, 1917. Temperature 101°, dropping to normal on third day. Convalescence as satisfactory until evening of the fifth day, when severe cramplike abdominal pain developed with repeated vomiting. Obstruction was complete for 24°, after which the bowels moved freely. On the tenth day, recurrent abdominal pain, with repeated vomiting. I saw her on the morning of the eleventh day when obstruction had been complete for 24°. Her abdomen was distended with prominent coils of small intestine visible in active peristalsis. Although it was obvious that this obstruction might relieve itself as the previous one had, it seemed safer under the circumstances to provide drainage. Operation, February 12th; ether, incision through inner border of rectus muscle. Abdomen free from adhesions except in region of old wound. Ileostomy by means of glass tube in loop of ileum as near as possible to adherent point of obstruction. Good recovery. Bowels moved freely three days later,

and regularly thereafter. Gradual lessening of faecal discharge from ileostomy, which closed spontaneously before discharge on the thirty-fifth day. November 22, 1919, her father writes that she is well, the wound has remained healed, and that she has had no pain or discomfort from the operation.

CASE 7. Ileostomy; recovery. Massachusetts General Hospital Record No. 216397; boy, aged 9. Operation, July 27, 1917; ether; appendectomy with drainage for acute appendicitis and diffuse peritonitis. A large quantity of thick free pus in abdominal cavity. Appendix gangrenous and perforated. Following operation vomiting ceased, and gas was occasionally passed, but moderate distention persisted and his condition was never satisfactory. On the fourth day, distention increased, partially relieved by enemata. On the sixth day, vomiting developed with marked abdominal pain. On the next day vomiting and pain continued. Enemata were without effect; distention was increased. Operation: median incision with novocaine anesthesia. Glass tube tied in dilated ileum with purse-string. Intestinal coils adherent with soft adhesions. The following day vomiting ceased, and distention was less. Five days after ileostomy there was a voluntary movement by rectum. The discharge from the ileostomy greatly decreased in the next ten days, and had almost ceased two days later. The boy was discharged on the thirtieth day, wound practically healed. His mother reports by letter November 23, 1919, that the boy's general health is very good, and that he has no discomfort except from a recurring sinus in his original appendix incision. The ileostomy has remained healed.

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THE SURGICAL TREATMENT OF ACUTE EMPYEMA BY VALVE DRAINAGE, PROVIDED BY FLAP OF SKIN, FASCIA, AND MUSCLE, UNDER LOCAL AND PARAVERTEBRAL ANESTHESIA.

By WILLIAM REID MORRISON, M.D., BOSTON.

Most surgeons agree that operations involving the opening of the thorax should provide proper closure of the chest wall, to prevent air going in and out of the wound, causing partial collapse of the lung, mediastinal flapping, pneumothorax, and subsequent chronic empyema. At the same time, adequate drainage must be provided for collections of pus, whether

free in the pleural cavity, encapsulated between the lobes of the lung, or walled off between the lung, spine, ribs, or diaphragm.

A valve of skin has been advocated by Dr. Fred B. Lund to prevent chronic empyema, which so often occurs after the old-fashioned method of making a direct opening in the chest with "collar-button," tubing or gauze drainage. The valve also eliminates considerable shock which would be present otherwise. Most satisfactory results have been noted by the author in civil practice by the use of this method.

Experience has convinced the writer that a flap of skin only, particularly in thin patients, is not as satisfactory as a valve of skin, subcutaneous fat, fascia, and muscle. The thicker flap occludes the opening in the thorax perfectly, while the skin flap alone tends to retract when the stitches are removed four or five days after operation. The skin flap only is infinitely preferable to the direct opening in the chest, and in most cases where a valve is used, the lung has expanded, obliterating any cavity which has not been of long standing, with thick, leathery walls.

Through the courtesy of Lieutenant Colonel Homer B. Smith, the author had the opportunity of operating on a consecutive series of acute empyema cases admitted to Base Hospital 51, of the Justice Group at Toul, France, during the war.

All of these cases were operated on under similar conditions. A hypodermic injection of one-quarter or one-sixth of a grain of morphine was given subcutaneously one-half hour before operation, according to the size of the patient. (Scopolamine, or atropine, one hundred and fiftieth, or one-hundredth of a grain may be given in addition to the morphine.) The instruments and sterile goods were arranged on the table, and the operator and assistants were ready to operate immediately, when the patient was brought to the operating room, to avoid delay. Benzine and half-strength tincture of iodine was used for skin preparation. As local and paravertebral anesthesia was employed in each case, Crile's anoci-association technique was carried out as far as possible, special care being taken to have neither display, nor rattling of instruments, which were hidden by sterile towels. The patient was placed in a half-sitting position on the operating table, with warmed blankets under, as well as over, the body and legs. Care should be taken that the patient

does not roll on the unaffected side, in the recumbent position. Serious, if not fatal, embarrassment of respiration may result, due to compression of the over-worked opposite lung. This is caused by the mediastinum being pushed over by the pressure of the fluid in the infected pleural cavity. The author has seen a death in civil practice because of failure to observe this precaution. One-half of one per cent. novocaine solution was used, and when novocain was unobtainable, one-eighth of one per cent. cocaine solution. Paravertebral anesthesia, blocking the intercostal nerves combined with the local infiltration in the skin and underlying soft tissues in the region of operation, is the anesthesia of choice for this type of chest surgery, and in the writer's hands, it has proved most satisfactory.

This method of draining the chest by an indirect opening, with formation of a valve (whether or not a pleurotomy or rib resection is made) renders the operation painless, with little or no shock to the patient, provided the nerve impulses are thoroughly blocked by an experienced operator.

In the ordinary empyema cases which have pus free in the pleural cavity, the valve should be placed posteriorly, draining the chest by means of a pleurotomy through the eighth, or preferably the ninth interspace, or resecting the eighth, or better the ninth rib, if necessary. The dependent part of the chest is properly drained, with the patient sitting or lying in bed. The tenth rib may be resected, but injury to the diaphragm is likely to occur: if injured, it should be promptly sutured.

To make the valve, a six-inch skin incision is made parallel to, but a distance of one rib and one interspace below the rib or interspace selected. The underlying fat, fascia, and muscle are incised, and retracted upward the width of one rib and one interspace; the selected interspace is incised, or rib resected.

On opening the chest, pus is allowed to escape slowly, by the insertion of a gloved finger, and collections of fibrin, detritus, or foreign bodies are removed gradually. The position of the lung is determined, and adhesions between the lung and chest wall may be separated. The patient is told to cough, which usually brings the lung in close apposition to the chest wall. When the patient coughs, pus drains freely from the chest, and with each inspiration the valve of soft tissues closes over the opening in

the thorax, causing a dimple over the resected rib, or interspace, thus preventing any inflow of air in the chest.

To insure subsequent drainage, a soft rubber tube two centimeters in diameter, and the width of the chest wall in length, is inserted in the oblique drainage tract. The outer end is sutured at its lower margin, to the inferior skin edge, with interrupted silk-worm gut sutures. The inner and outer ends of the tube of rubber are not cut transversely, but on a slant, and parallel to each other, making them flush with the chest walls. The skin incision is sutured loosely with interrupted silk-worm gut sutures, so that no tubing is seen at all. Gauze strips impregnated with boric ointment, or sterile vaseline, such as are used in the Dakin dressings, are placed about the wound to protect the skin, and plenty of gauze dressings are applied under a swathe. This dressing is not disturbed for several days, as advised by Dr. F. J. Cotton, but it is reinforced if necessary. On the third or fourth day, the stitches and tube are removed.

X-ray and fluoroscopic examinations were made before the operation and a series of plates were taken every three days afterwards; these plates demonstrated efficient valve drainage.

Four of my series were pneumococcus cases, all of which recovered.

1. Peter K., 2,418,856, Private, Company B, 147th Infantry. Eighth rib resected, posterior axillary line. (Seen at my office in November, 1919, in good health. X-ray by Dr. Samuel W. Ellsworth negative.)

2. Harvey S., Private, Company L, 18th Infantry. Ninth rib right resected, posterior axillary line.

3. John M., Private, Guard Company, 4th Repair Division. Ninth interspace left pleurotomy, posterior axillary line.

4. ——— (name lost.) Tenth rib resection left, posterior axillary line.

One case of mixed infection, streptococcus and pneumococcus, John M., Private, Machine Gun Company, 139th Infantry, had ten centimeters of an exploring needle broken off in the lung by a medical officer. An encysted empyema was found in the anterior of the right chest, just above the diaphragm. Valve drainage was made through the anterior of the chest; the seventh rib was resected in the anterior axillary line, the needle was removed; the patient died a month later.

Another case of mixed infection: Private David F., 1,903,964, Supply Company, 326th Infantry, was operated on for gunshot wound

of the abdomen, with perforation of the stomach, at a field hospital. On account of heavy shelling it was necessary to transport the patient to Toul, and in the ambulance, during a fit of coughing, he burst open the abdominal wound. The intestines were replaced in the abdomen and the wound resutured by the writer. Two months later during a stormy convalescence, the patient developed a left empyema, and he died two months after the operation.

There were six hemolytic streptococcus empyemas, of whom three recovered, and three died. At autopsy, Captain Pratt, the pathologist, was surprised to find no fluid in the affected chest, demonstrating the efficiency of the valve drainage.

Most of these cases, having seen active service at the front, contracted influenza while they were in poor physical condition, caused by exposure, poor nourishment, shell-shock, etc., with empyema following. Prostration was marked, the pulse often being 140 before operation, and each patient had the characteristic brownish watery fluid in large quantities.

1. Perry M., 2,846,421, Private, Company B, 342nd Machine Gun Battalion. Ninth interspace right, posterior axillary line. (Influenza and broncho-pneumonia at Field Hospital 148. Acute otitis media right.) Recovered.

2. Robert L., Private, 2,853,611, Company A, 360th Infantry. Eighth rib right resected, posterior axillary line. Recovered.

3. John E. H., Private, 2,005,423, 112th Infantry. Eighth rib right, resection in posterior axillary line. Died three days later.

4. William G., 294,987, Casual Detachment. Ninth rib resection, left posterior axillary line. Died three days after operation.

5. ——— (name lost). Eighth interspace left. Pleurotomy, posterior axillary line, died in twenty-four hours.

6. ——— (name lost). Eighth rib right resection, posterior axillary line. Recovered.

My impression is that the less done to these hemolytic streptococcus cases the better. Valve drainage is far better than the ancient direct opening in the chest, but I believe that the insertion of Kenyon's drain, as advocated by Willy Meyer, may become the operation of choice, with or without suction, in cases with free fluid in the chest. In my opinion many such cases are overwhelmed by the virulence of the infection, and they have not sufficient resistance to the hemolytic bacteria; such patients may die either with or without an op-

eration. Fortunately hemolytic streptococcus empyema cases are rare in civil practice.

The wretched conditions, at times, in the active service of military life abroad were very different from those at home, consequently the spread of this virulent infection was increased and individual resistance was diminished.

At Camp Wheeler the writer had some experience with Carrel-Dakin irrigations; by its use the odor of the discharge was cleared up rapidly, and the wound rendered cleaner, but the convalescence was not materially altered. Irrigations had to be omitted in one case, because of violent coughing, caused by the solution, which was prepared freshly every day, and carefully titrated. It is very difficult to bring the solution in contact with all parts of a tortuous drainage tract after an open operation and this is one of the essentials for producing results by means of the Carrel-Dakin technique. Whittemore inserts rubber tubing through a trocar and irrigates with Carrel-Dakin solution, making use of negative pressure as well, in a closed method of draining the chest.

CONCLUSIONS.

1. The advantages of this valve drainage are:

a. An indirect valve opening is made in the chest.

b. A valve made of the living tissues themselves is the most efficient type, because it does not get out of order. Mechanical valves in aspirating trocars, and devices such as a rubber dam pasted on three sides of the wound, are less desirable.

c. In cases of pneumococcus and mixed infection, masses of fibrin, detritus and pus are readily removed. The gloved finger is able to break up any recently formed adhesions which may anchor the lung, and which may prevent its expansion. The patient is told to cough, and usually the lung expands readily, obliterating any cavity.

d. Foreign bodies, if any, may be extracted.

e. Collapse of the lung, mediastinal flapping and pneumo-thorax may be avoided.

f. More rapid convalescence, avoiding chronic empyema.

2. No empyema should be operated on before a careful consultation with the medical man in charge of the case.

3. Too early or too late operation is to be avoided. The duration, extent, and virulence of the process in the lung, embarrassment of respiration from large amounts of fluid, and progress of the case are the factors that influence the surgeon's judgment.

4. Local, combined with paravertebral injection, is the anesthetic of choice.

5. a. In pneumococcus cases, valve drainage with pleurotomy or rib resection with indirect drainage of the chest may be used to advantage.

b. In streptococcus cases, particularly in hemolytic streptococcus infection, Kenyon's tube, with or without suction, or repeated aspirations may be of value, allowing no air to enter the chest.

6. The surgical treatment should be supplemented by careful attention to a high caloric diet, principally milk and raw eggs for the first few days.

7. Medication in the form of digitalis leaves or other cardiac stimulants to tide over the lung infection, morphine for pain, tincture nux vomica as an appetizer, and later iron are given as indicated.

8. Good nursing, warmth, and fresh air are absolutely essential.

9. Early bottle-blowing and later proper gymnastic exercises are desirable to stimulate lung and chest expansion and prevent deformity.

10. A half-sitting position aids respiration and drainage after operation.

11. A direct opening into the pleural cavity should not be made in acute empyemata.

12. The writer has not been favorably impressed by the use of serological treatment.

CHEST CONDITIONS RESULTING FROM WAR WOUNDS AND THEIR SURGICAL TREATMENT.

BY B. H. ALTON, M.D., WORCESTER, MASS.

In writing this article it is my desire to bring before you a few conditions of the chest resulting from war wounds and their surgical treatment as practised in the British casualty stations in France.

War wounds of the chest vary in so many respects that an adequate description of them