

**Amputation of the entire upper extremity (including the clavicle and scapula) for sarcoma following fracture of the clavicle ; Extensive thoracoplasty by Schede's method / by W.W. Keen.**

**Contributors**

Keen, William W. 1837-1932.  
Royal College of Surgeons of England

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London NW1 2BE UK  
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EXTENSIVE THORACOPLASTY BY SCHEDE'S  
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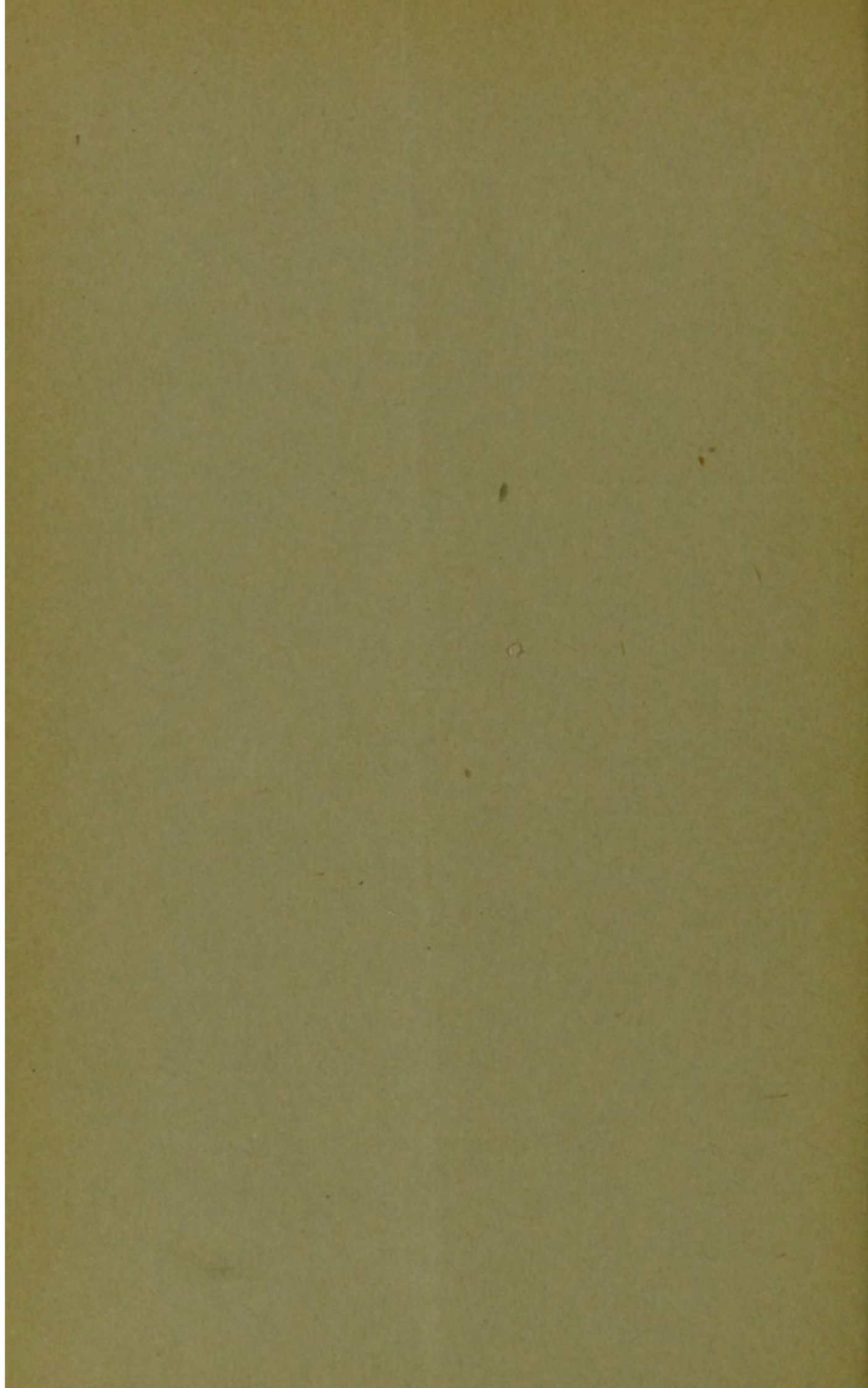
BY

W. W. KEEN, M.D.,

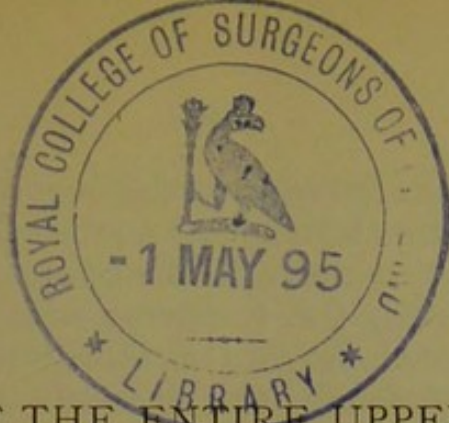
PROFESSOR OF THE PRINCIPLES OF SURGERY AND OF CLINICAL SURGERY,  
JEFFERSON MEDICAL COLLEGE, PHILADELPHIA.



*Read before the Philadelphia Academy of Surgery,  
February 4, 1895.*







AMPUTATION OF THE ENTIRE UPPER EXTREMITY  
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By W. W. KEEN, M.D.

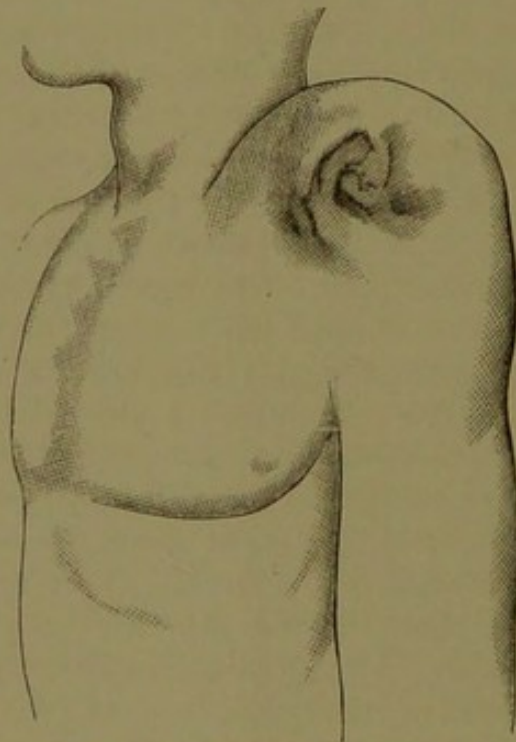
E. S., aged twenty-one years, first consulted me early in December, 1894. In May, 1893, he broke his left collar-bone by a fall. In June, 1894, a tumor appeared at this point, which together with one-and-one-half inches of the clavicle, was soon afterward removed by Dr. Stout, of California. The tumor, however, immediately reappeared, and has grown rapidly ever since. For the last month he has been under the care of Dr. Coley, of New York, for treatment by the erysipelas and prodigious toxins, but the tumor steadily enlarged. At present there is a large tumor extending from the shoulder to the base of the neck and attached to both clavicle and scapula. It reaches to within two inches of the inner end of the clavicle. I deemed it, however, still possibly operable, because it did not seem to be infiltrating but encapsulated. This conclusion I based upon two grounds: First, that the tumor seemed to be very movable with the shoulder, and, secondly, there was not the slightest edema of the arm. This convinced me that the vessels, and especially the veins, were not yet involved. I told him frankly that it was uncertain whether I could remove the growth, but that if he desired it I would attempt the operation, since he could at least be no worse off by its removal, and even if death followed it would relieve him from weeks or even months of great suffering. He and his family readily consented to operation.

The tumor was ulcerated at two points, and the skin was branny and thick. The conditions, therefore, were unfavorable to a thorough asepsis, but the parts were as thoroughly disinfected as possible. My plan was to adopt the method as described in my paper before the American Surgical Association in May, 1894 (*Transactions American Surgical Association*, 1894, p. 55, and *American Journal of the Medical Sciences*, June, 1894),



namely, to make one incision at the inner border of the tumor with its centre at the clavicle, and another at a right angle along the line of the clavicle down to the bone, to dissect these flaps, and by drawing away the tumor to uncover as much of the clavicle as possible, removing as much of the inner end as I could, and then search for the vessels. If I found that they could be easily ligated, I should then proceed to remove the entire upper extremity. If, however, the vessels could not be reached that I should then close the wound and abandon the operation. Profs. Brinton and Hearn, after careful examination of the patient, both agreed with me as to the advisability of attempting it. Accordingly, he entered the Jefferson Medical College Hospital on December 24th. His temperature was then  $100^{\circ}$ . His pain was so severe and constant as to deprive him of much sleep. He was, however, generally in very fair health, though not strong.

FIG. 1.



Sarcoma of shoulder from fracture of the clavicle. (From a photograph.)

*Operation, December 26, 1894.* The plan outlined above was carried out. I removed two-and-one-half inches of the inner end of the clavicle. Drawing the tumor away, and scraping it from the clavicle enabled me to remove much more than I had expected. I then sought for the vessels, and was so fortunate as to be able to dissect them loose and follow them down to the upper border of the pectoralis minor. At no point did I find the tissues under the great pectoral involved. In order to tie the vessels at so low a point I had gradually extended my vertical



incision nearly to the axilla, and having secured the vessels I then decided to proceed with the amputation. It was evident that removing the tumor would remove so large a portion of the skin that it would be impossible to approximate the edges. Accordingly, I determined to carry my incision down on the arm nearly to the elbow and to dissect a flap of skin which was healthy from the inside of the arm, and turn it upward so that the lowest end near the elbow would become the highest when turned upward on the neck. In dissecting the arm loose I removed the larger part of both the pectoral muscles and had to tie a number of smaller vessels. The posterior incision was now made, cutting as wide of the tumor as was possible, the incision passing nearly along the posterior border of the scapula. The separation of the extremity was now readily effected, and a moderate number of vessels ligated. After renewed disinfection of the large surface it was closed. The elbow flap was turned upward on the neck and enabled me to cover the entire raw surface by skin without any tension. As the skin of the inner side of the arm near the elbow derived its nourishment not from the branches of the vessels from the axilla, but lower down from the arm, its transplantation was analogous to skin-grafting, and I regretted afterward that I had not been very careful to dissect from its inner surface all the fatty tissue, of which only a little, however, was left. At four points I inserted between the stitches small portions of iodoform gauze to act as drains.

The patient was put in bed with apparently little shock, his temperature being  $97.6^{\circ}$ , though the operation had lasted nearly two hours. His recovery was rapid and satisfactory, the temperature only rising once to over  $100^{\circ}$ . On the sixth day he was out of bed. A small portion of the posterior edge of the flap from the arm sloughed. But for this he would have been entirely well within ten days.

REMARKS. At the meeting of the American Surgical Association in Washington, May 29, 1894, I read a paper on "Amputation of the Entire Upper Extremity, Including the Scapula and Clavicle, and of the Arm at the Shoulder-joint, with Special Reference to Methods of Controlling Hemorrhage." The key of the whole situation, as I there pointed out, is very clearly the control of the hemorrhage. In the present case operation had been declined by several surgeons on the ground that the disease was too extensive for a successful amputation. I was convinced, however, that the vessels were not yet invaded, because there was no edema of the arm, and, also, on moving the tumor in various directions it seemed to me not to be so adherent as to prevent my getting under it and obtaining access to the vessels. My impression was that I



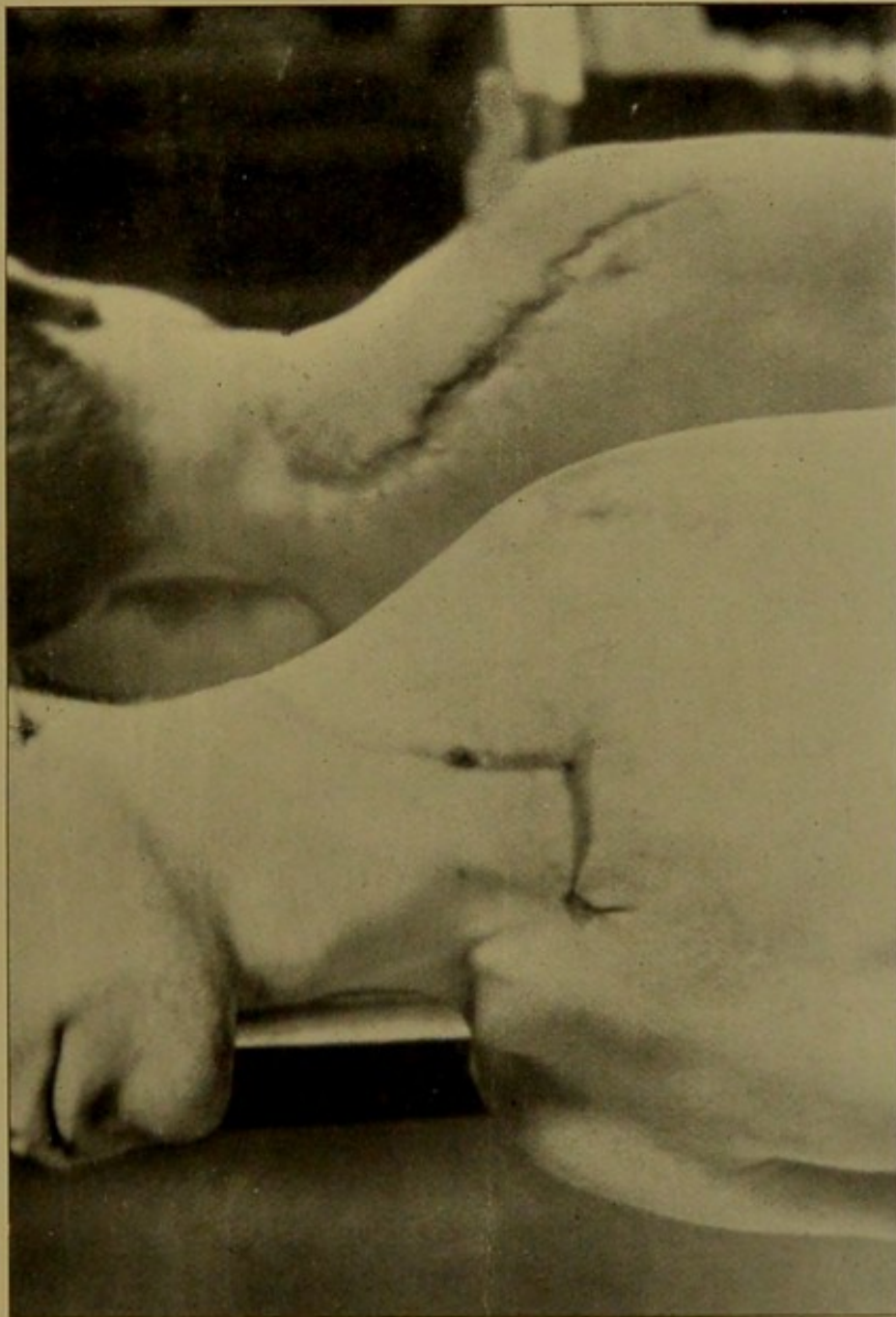
would be obliged to ligate the subclavian vessels in the first part of their course; but, after resecting the clavicle and tearing through the tissues behind it, one of my assistants was able to drag the tumor outward, and this gave me an unexpectedly easy access to the vessels, which I was able to follow down to the first part of the axillary artery and tie them there. I was the more anxious to tie them low down, because I foresaw that it would be needful to utilize the skin of the inner arm to fill the gap left by the removal of the tumor. Had this not been done a very large raw surface would have been left, either to granulate or to be covered by skin grafting. I very much feared that even so high a ligation as the first part of the axillary would be followed by some sloughing of the flap of the skin, but fortunately, only the posterior edge of this flap sloughed to a small extent and delayed the healing for about ten days or two weeks.

I was unable to follow the typical method of Berger or that of Treves, but was obliged literally to "cut my coat according to my cloth." The branch of the brachial plexus of nerves going to the great pectoral was very easily seen and was a very good guide to the vessels. Each vessel was tied with two ligatures of silk, and the vessel divided between them; the artery was tied first, in order to diminish the amount of blood in the vein, and I found this way very advantageous. The amount of blood lost was not very great, and the shock of the patient was very moderate. He made a most gratifying, uninterrupted recovery. Later, when the slough had separated, a few stitches were inserted to draw the granulating surface together.

He weighs less by six pounds than when he entered the hospital, but the portion removed was about ten pounds, so that he has gained about four pounds. The operation was done the day after Christmas, that is, forty-one days ago. This is the second operation of this character that I have done. There was very little shock in either case, although the operation lasted two hours. The first patient was out of bed in five days; this patient was out of bed in six days. The shock was much less than I expected from such an extensive dissection. The patient is now in good health. Fig. 2 shows his present condition.

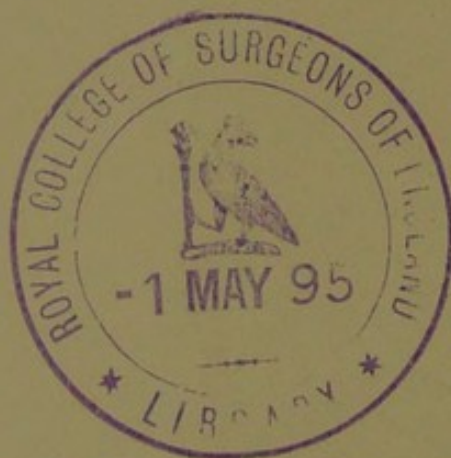


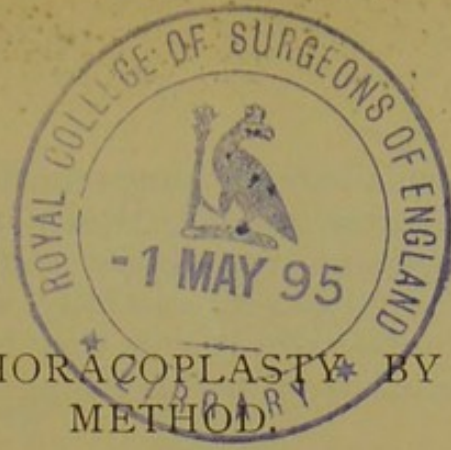
FIG 2.



Resulting scar after amputation of the entire upper extremity. (The posterior part of the scar is shown in a mirror. Photographed by J. M. Bertolet.)







EXTENSIVE THORACOPLASTY BY SCHEDE'S  
METHOD.

By W. W. KEEN, M.D.

A. K. S., of Blacklick Station, Indiana County, Pa., aged thirty years, was admitted to the Jefferson Hospital, March 11, 1894.

The family history is negative. He had all the usual children's diseases, and four years ago a severe attack of enteritis. Twelve years ago, after a severe attack of pneumonia lasting six weeks, left-sided pleurisy set in. Two months later a small incision was made between the sixth and seventh ribs just to the left of the nipple line, and a drainage-tube was introduced. For fourteen months a small amount of pus escaped through the opening after removal of the drainage-tube. Then the opening was enlarged, and over two quarts of pus were evacuated in twelve hours. A large drainage-tube was then inserted. He immediately began to gain in weight, and says that he gained thirteen pounds in the first fourteen days. His weight had been as low as ninety pounds, though he is six feet tall.

*Status præsens:* Weight, 145 pounds; appetite good, and he feels very well; no bloody expectoration. Between the sixth and seventh ribs, just to the left of the nipple line, is a drainage-tube which he has worn continuously for nearly eleven years. About half an ounce of pus escapes from it in twenty-four hours. Occasionally it is blood-stained, and he has had an even greater amount of blood escape when excited by coughing or by the introduction of a new tube, sometimes losing over a half pint of blood. The whole left chest is much sunken in.

*Operation March 14, 1894.* A vertical incision was made just outside the line of the nipple, and about two inches of the seventh and eighth ribs were resected, exposing the upper surface of the diaphragm. Starting from the opening in the chest cavity, it was with the greatest possible difficulty that I could resect the ribs, since they were absolutely in contact as the result of the deformity of his chest. The pleura was also over an inch in thickness, which made the thickness of the chest-wall about two inches, and therefore very rigid.



In addition to this the left lung was firmly bound down and so contracted that there was practically little lung tissue in use. Hence, as his respiration was almost confined to the right lung I had to watch the ether very carefully, and by the time that I had resected these two ribs it was very evident that the operation should be terminated, and anything further left for a future date.

The wound was packed with iodoform gauze. His highest temperature after the operation was 99.8°. The cavity of the chest was washed out with pyoktanin, boric acid, sublimate solution, etc., at different times.

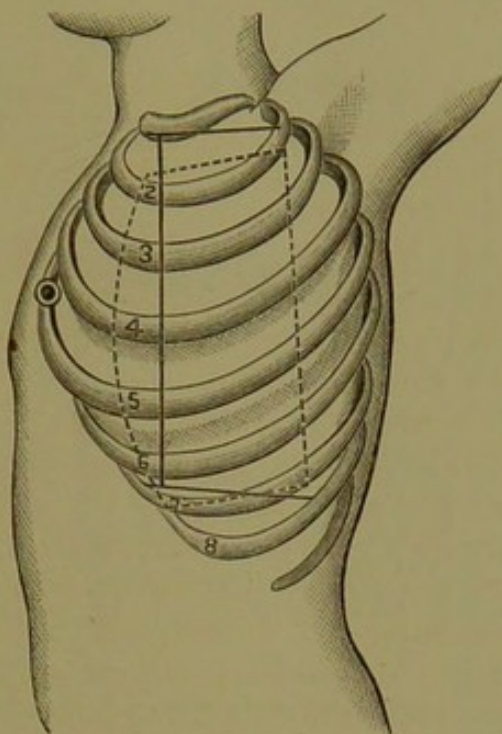
He left the hospital May 28, 1894, in much better health and with little annoyance from the large cavity remaining in the chest, from which the discharge was comparatively slight. He is to return for a second operation.

*Second operation, Jefferson Hospital, June 30, 1894.* Examination by a long probe showed that the cavity of the pleura was very large and extended to a level with the clavicle. My intention was to resect as much of the chest-wall as possible. I was obliged to be extremely careful of the anesthetic, as I had been in the previous operation, lest, having little more than one useful lung, the anesthetic and the operation together might prove fatal. I made a vertical incision from the clavicle to the still-existing opening into the chest cavity, followed by two horizontal incisions at each end of the first. I then dissected the soft parts from the ribs internally to within an inch of the left border of the sternum, and externally to a point an inch posterior to the anterior border of the scapula. Then, guiding a large pair of bone forceps by my finger, and starting from the existing opening, I cut ribs, muscles, pleura vessels and nerves, *i. e.*, the entire thickness of the chest wall up to and including the second rib, then, starting again from the prior opening outwardly to a point a little in front of the inferior angle of the scapula skirting the upper surface of the diaphragm, then from this point directly upward, and again horizontally on a level with the second rib. Most of this large mass, on account of its thickness, had to be removed piecemeal, part of it in two or three large pieces. The size of the portion removed was approximately eight inches vertically by five inches horizontally. A number of the larger intercostal arteries bled, but were seized with hemostatic forceps, and finally, even without ligation, on the application of very hot water, ceased bleeding. The inner wall of the cavity was found to be enormously thickened visceral pleura and pericardium, stretching like a vertical diaphragm from front to back at a point about an inch external to the left border of the sternum. This was thoroughly curetted and swabbed. The



flaps were then laid directly upon the thickened pleura and pericardium and sutured in place. His recovery was without incident, though slow. The reaction was very moderate.

FIG. 1.



The solid line shows my incision. The dotted line shows the portion of the bony and muscular chest wall removed. The posterior line should be further back.

*October 6, 1894.* He came to the hospital again to-day to see me, and I found the only remnant of the wound was a cavity about as thick as a lead pencil and an inch-and-a-quarter deep. With light packing this will soon heal. His chest is very much deformed from falling in of the wall, but the cavity is entirely obliterated. His general health is excellent.

The opening closed entirely about the middle of November, and he is present this evening for your inspection.

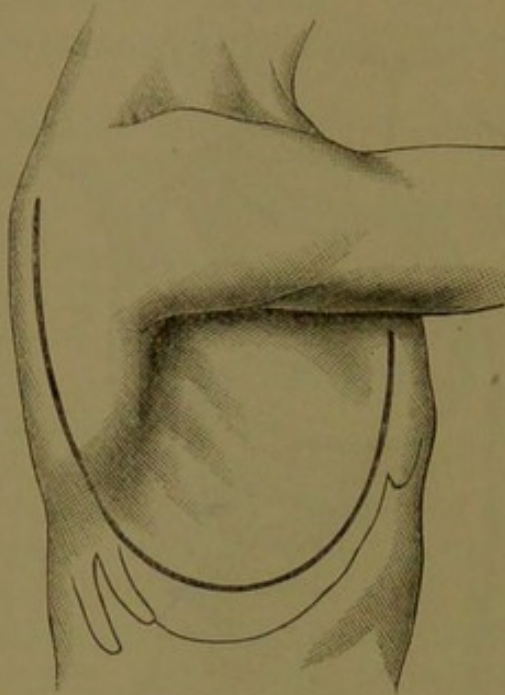
REMARKS. The present is by far the most extensive resection of the wall of the thorax that I have ever done. The first operation was practically preliminary, simply to gain access to the cavity of the pleura, and had to be terminated somewhat abruptly on account of the difficulty of the etherization. The second operation was attended with less difficulty from the anæsthetic, and was fully carried out.

The operation which I made I have subsequently found has been described by Schede as a modification of Estlander's operation, or rather, perhaps, in suitable cases as a substitute for it. In the present case Estlander's operation would have been useless, on account of the immensely thickened pleura.



Schede makes a large, semi-circular flap (Fig. 2), with its base at the second rib, its curve beginning on the front of the thorax

FIG. 2.



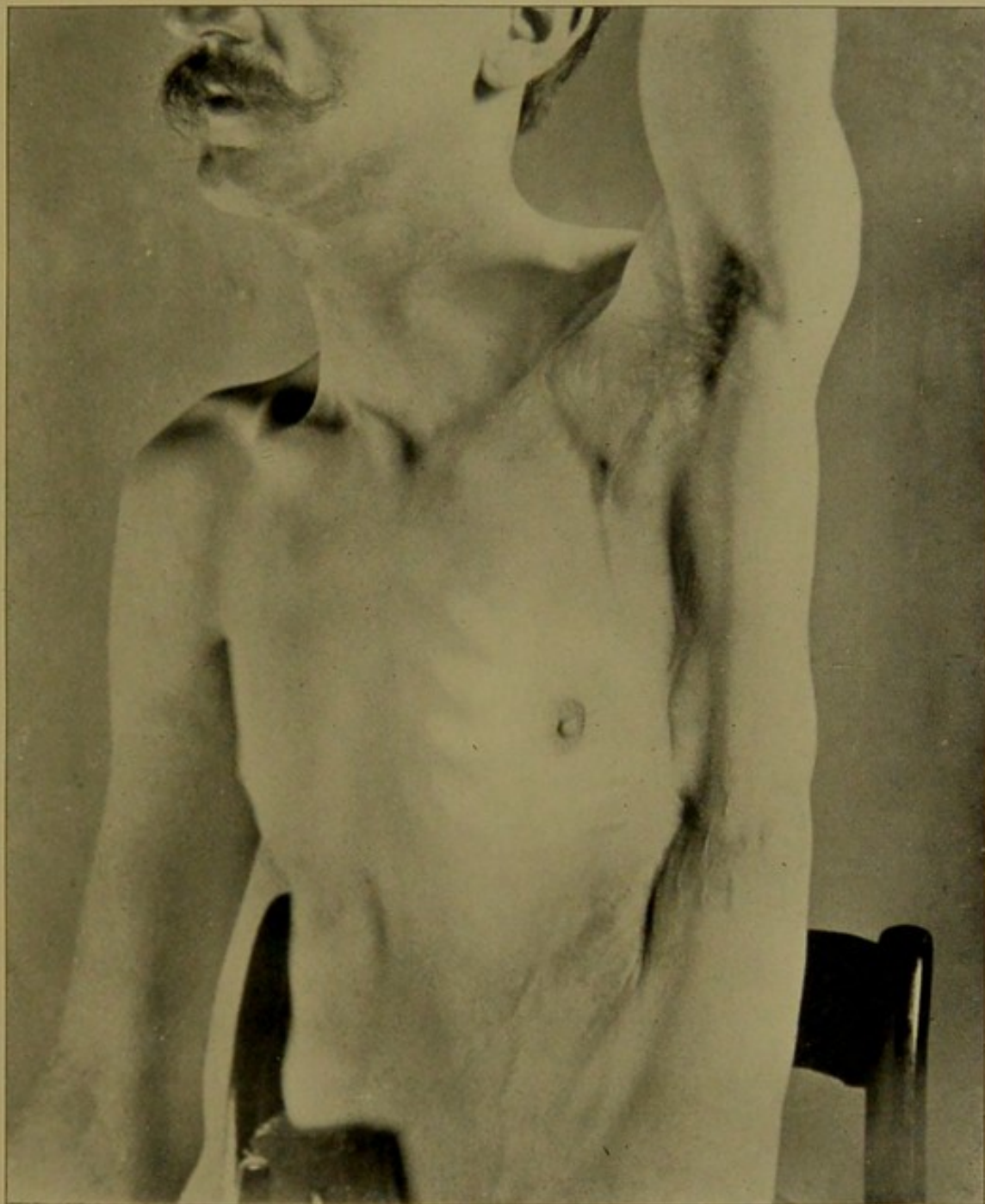
Schede's incision for thoracoplasty. (ESMARCH.)

and sweeping downward and backward in a large curve which includes the larger part of one-half of the thorax. In my own case, the soft parts were dissected from the ribs by a vertical incision with two horizontal incisions at the upper and lower ends of the first, making an  $\Gamma$  (Fig. 1). It seemed to be equally satisfactory with that of Schede.

The ease with which the operation was done, and the admirable result, commend it to me very strongly. Nothing less radical would have effected a cure. The vessels were controlled without the slightest difficulty by hæmostatic forceps, not even a single one requiring ligation.

His present condition (Fig. 3), eight months after the second operation, is curious. The thoracic wall, where its entire thickness has been removed, is as firm and resistant as if the ribs had never been removed. This may be due to two causes: First, the tension of the soft parts of the old chest-wall, which stretch like a drum-head from the anterior to the posterior border of the opening I made; second, the thickened pleura and pericardium on the median surface of the old empyemic cavity, furnish a very firm resistant base on which the flap presumably rests. I intentionally use the word "presumably," for on percussion the entire left chest is resonant, and even tympanitic, as if there

FIG. 3.



Result after thoracoplasty. Note the mobility of the arm.  
(Photographed by J. M. Bertolet.)





were a pleural cavity still existing. Were this really the case there would certainly, however, be a considerable amount of pus secreted, and this can scarcely be the fact, in view of the healing of the cavity for so long a time. Moreover, in October last, when I examined him with a probe, no cavity, but only a small sinus existed. The lung can hardly have expanded enough to fill the cavity, for a pleura an inch thick can scarcely have been absorbed to such an extent as to allow of such expansion. The respiratory murmur, however, is heard for an inch external to the left border of the sternum.

The posterior portion of the ribs form a marked projecting ridge near the posterior axillary line. It looks as if the resections were much less extensive than I have described, but this is due to a lateral curvature of the spine to the left, thus making the spinal part of the ribs much more prominent than would otherwise be the case. The movements of the arm are perfectly free (Fig. 3), the removal of the greater part of both pectoral muscles having had no restraining effect upon this free shoulder motion.

The apex beat of the heart is in the normal situation.

He has not gained in weight very much, but his general health is excellent.

*Third Operation.* A few days after he was shown to the Society the wound broke open again and discharged a small quantity of pus. I then did a third operation, removing some more of the chest wall at the upper posterior angle. I found a cavity  $3\frac{1}{2}$  inches long and as thick as the thumb. This is now (March 27th) nearly obliterated by granulation tissue. His general health is reëstablished, and he is now, I believe, entirely cured.



