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Contributors

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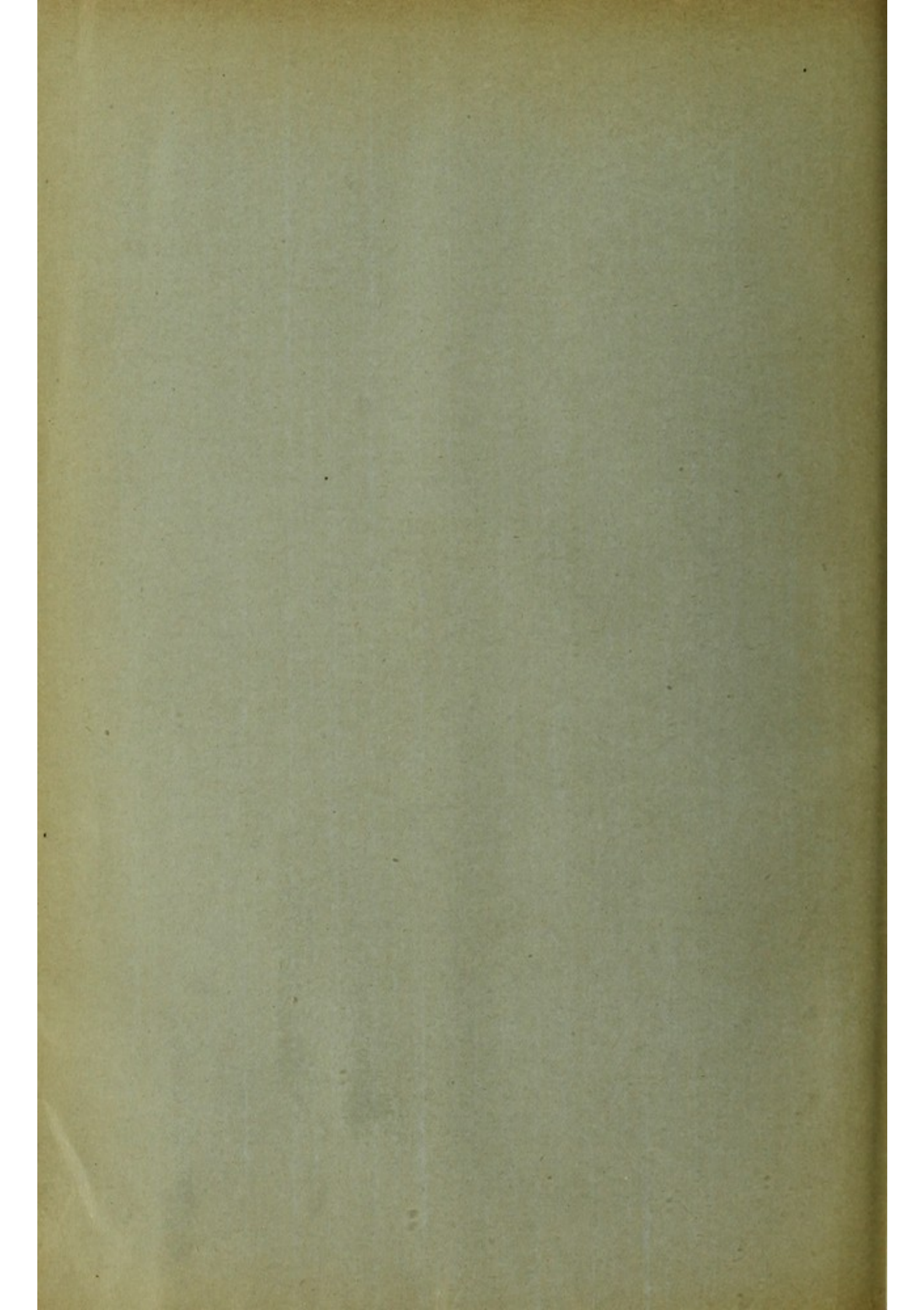
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Resection of the Sternum for Tumors,
with a Report of Two Cases and a
Table of Seventeen Previously Reported Cases.

BY

W. W. KEEN, M. D., LL. D., Philadelphia.





RESECTION OF THE STERNUM FOR TUMORS, WITH THE REPORT OF TWO CASES AND A TABLE OF SEVENTEEN PREVIOUSLY REPORTED CASES.*

W. W. KEEN, M.D., LL.D.,† PHILADELPHIA.

CASE I.—*Resection of the Manubrium, Inner Third of the Left Clavicle and Lower Third of the Left Sterno-Cleido-Mastoid for Sarcoma.*

nine months before she had noticed a spot of tenderness at the right sterno-clavicular articulation, over an area about two inches in diameter. This disappeared in about

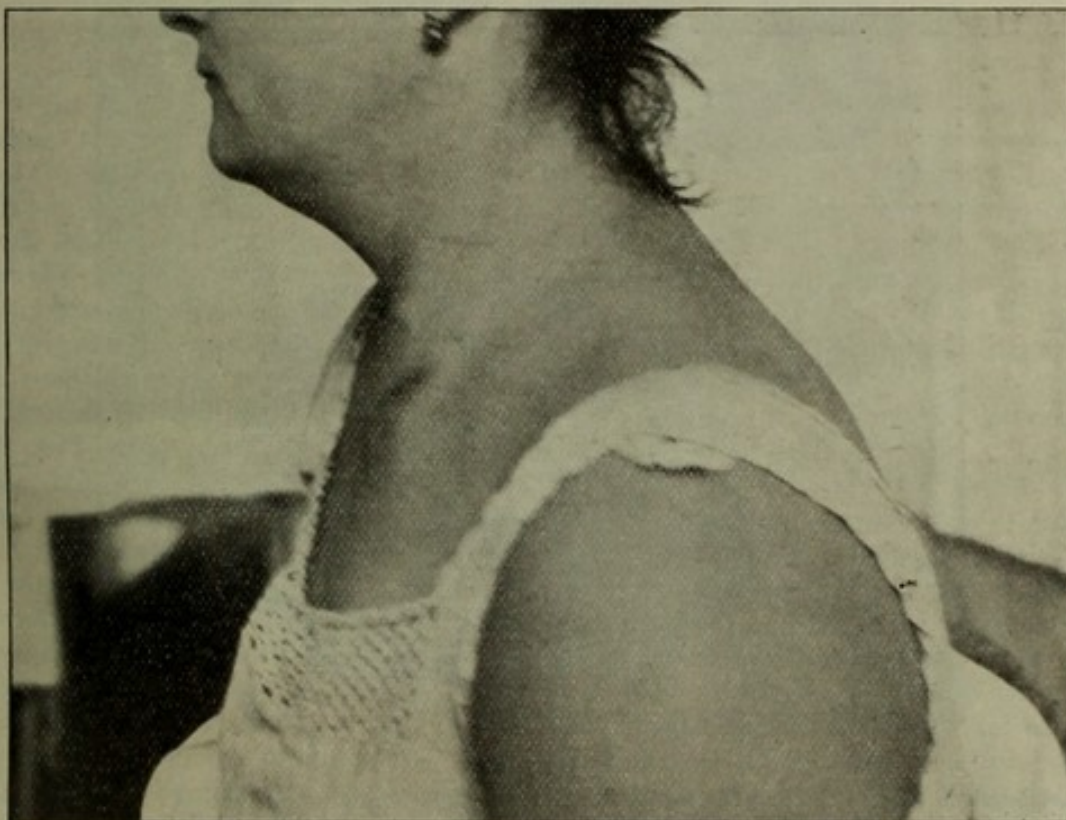


FIG. I.

Sarcoma of Manubrium Left Clavicle and Sterno-cleido-mastoid.

Mrs. F. ———, twenty-eight years old, was admitted to Jefferson Medical College Hospital, November 18, 1895. About

a week. A month later a similar spot appeared at a corresponding point on the left side. This swelling developed gradually into a moderate tumor, which became tender and occasionally painful. When the patient came under obser-

*Read before the Philadelphia County Medical Society, February 24, 1897.

†Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia.

vation it covered the end of the clavicle and the upper left portion of the manubrium, and there were two small nodules over the lower end of the sterno-cleido-mastoid. (Fig. I.)

A careful investigation of the woman's history led me to disbelieve that the swelling was possibly syphilitic. This view was

as to prevent the removal of the manubrium. This was the first point to determine. I therefore first made a semi-circular incision, beginning at the right sterno-cleido-mastoid insertion into the clavicle, arching up into the neck, and ending below the middle of the left clavicle. By blunt dissection I then freed

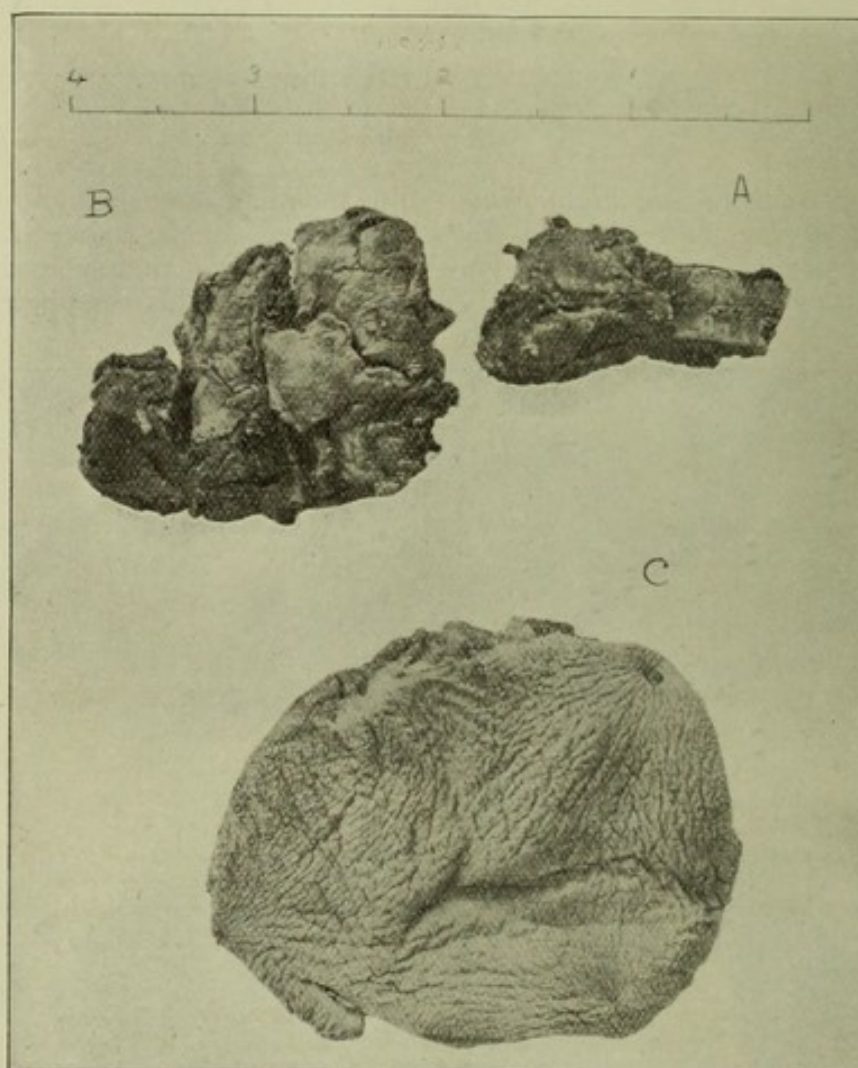


FIG. II.

The parts resected (except the first rib):—A. The Clavicle. B. The Manubrium. C. The Tumor in front of the Bones and the Sterno-cleido. (Four pins to hold it when photographed, looking like depressed nipples, are seen at the four corners.)

further supported by the fact that before her entrance into the hospital a thorough course of anti-syphilitic treatment had resulted in no improvement. The diagnosis, therefore, was made of a sarcoma.

Operation, November 20, 1895.—The only question in my mind was whether there were such adhesions behind the bone

the tissues at the inner border of the left sterno-mastoid, inserted my finger well behind this muscle, and worked my way downward behind the manubrium sufficiently to determine that there were no such adhesions as to prevent the resection that I contemplated. I then divided the sterno-mastoid at the junction of

its lower and middle thirds, and removed the lower third of the muscle, together with all the diseased tissues from in front of the sternum and clavicle. (Fig. IIc.) This laid bare the clavicle and the sternum, both of which I found were more or less worm-eaten by disease. Carefully loosening the tissues behind the clavicle, I then sawed this bone at the junction of its inner and middle thirds, and removed the inner third of the clavicle entire. (Fig. IIa.) I next separated the cartilage of the first rib from the parts behind it, and removed one inch of the inner end of the rib. The manubrium was then free, both above and to the left, and I was enabled gradually to insinuate my finger behind the manubrium, and separate it from the tissues of the mediastinum. A strong pair of bone-pliers was then passed behind the manubrium, and it was divided just to the left of its right border, and then horizontally just above the joint between the manubrium and the gladiolus, and removed. (Fig. IIb.) None of the vessels at the base of the neck was laid bare, excepting the left jugular, but the pulsation of the arch of the aorta was perfectly perceptible. Fig. III shows in a diagrammatic way the parts removed. A few small vessels were cut and tied. The skin was undermined, both above and below, and approximated as closely as possible, but a considerable gap was left in the center, between the two flaps. Moreover, the flaps did not rest on the soft parts behind them. In dressing the wound, therefore, I endeavored, by means of compresses and a bandage, to bring the surfaces in contact.

The patient stood the operation very well, but little blood being lost. The tension on the stitches was very great, so that in a few days they ulcerated through to a considerable degree, and caused both redness and suppuration. By the third day the temperature had risen to 102.5° . In the considerable cavity corresponding to the upper portion of the mediastinum pus accumulated, and there was much danger of its burrowing downward into the anterior mediastinum and, as I especially feared, towards the apex of the left lung.

Accordingly, I drained the cavity most satisfactorily by Catcart's apparatus as modified by myself.² By the ninth day the temperature had fallen to the normal, and, with slight fluctuations within a very narrow range, remained at this point till

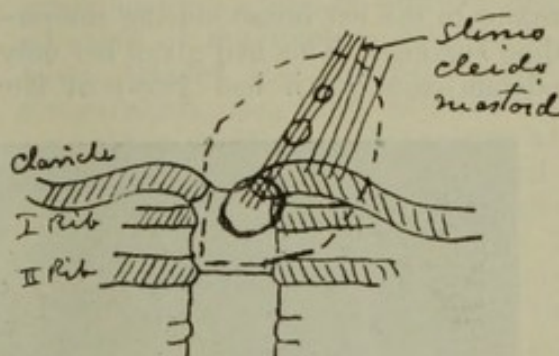


FIG. III.

Diagram of the Resection. All the parts within the interrupted line were resected. The three circles represent the sarcomatous nodules.

the patient was discharged January 26, 1896, with a small ulcer yet unhealed. Soon afterward the entire surface healed.

I have the pleasure of showing the patient to you to-night (Fig. IV). You will observe a slight tendency to keloid in the scar; otherwise there is nothing abnormal. The pulsation of the aorta and innominate can be both seen and felt. Her general health is excellent. No return has occurred after more than fifteen months.

The specimens were given to Dr. D. B. Kyle, who reported as follows:—"Sections of the tumor of the sterno-mastoid muscle showed, in certain areas, round-cell infiltration, with vessels showing embryonic walls. Certain areas showed adult fully developed structure, but there was sufficient characteristic structure to warrant the diagnosis of sarcoma. Sections of the rib showed round-cell infiltration, but not in itself characteristic of sarcoma. Sections of the manubrium were more marked, it being typical round-cell (small) sarcoma. Certain minute areas showed cystic degeneration."

CASE II.—*Carcinoma of the Breast; Secondary Carcinoma of the Sternum at the Junction of the Manubrium and the Glad-*

² *Annals of Surgery*, February, 1896.

iolus. Successful Removal of Both Breasts ; Resection of Parts of the Manubrium and Gladiolus ; Recovery. Death from Recurrence.

Mrs. B., 44 years years old, was first seen with Dr. J. H. Beck, of Philadelphia, February 17, 1892. She had first noticed a tumor in the left breast during the preceding summer. This had given her only moderate pain, but it had grown of late

On January 19, 1894, the sternum showed a slight bulging at the junction of the manubrium and gladiolus. Whether this was a normal angulation which had escaped my notice, or an infection of the bone, I was uncertain.

On February 19, 1894, the thickening of the sternum had distinctly increased, and I also discovered a small nodule in the right breast at the inner border. No

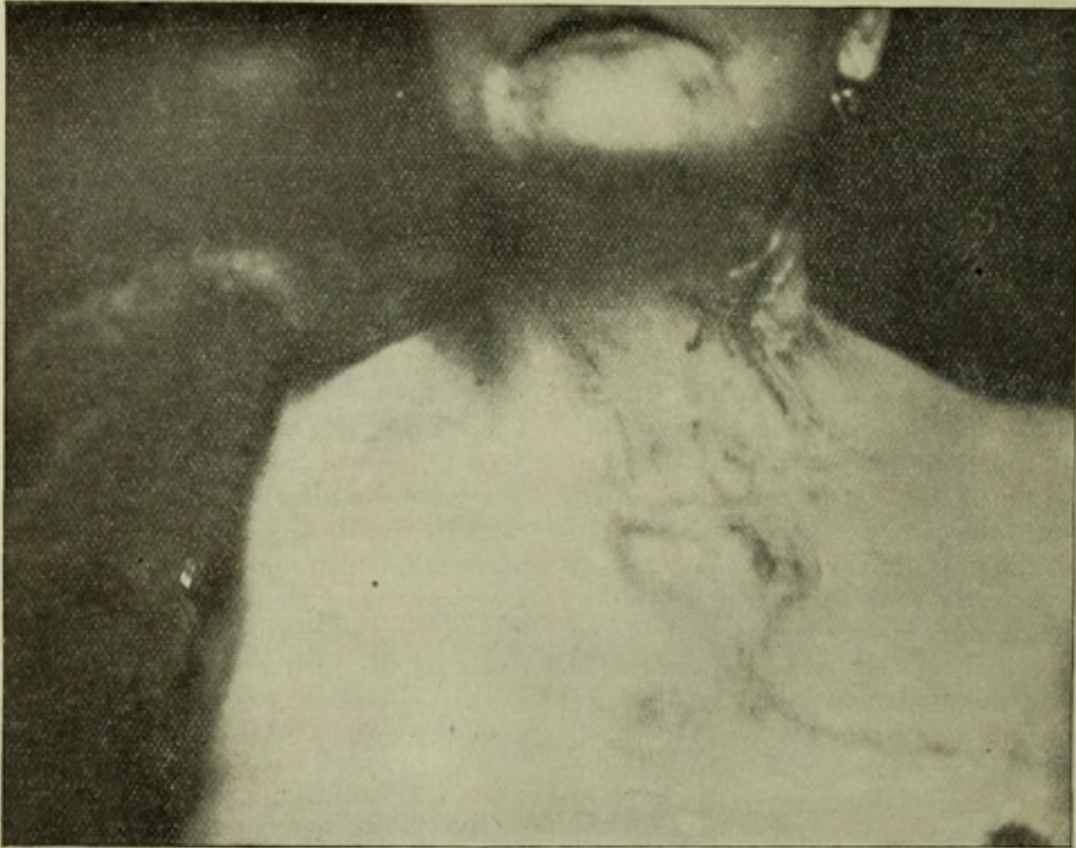


FIG. IV.
The Present Appearance of the Patient. (Case I.)

rather rapidly. Examination showed a tumor two and a-half inches in diameter in the upper outer quadrant, the nipple just beginning to retract. The axillary glands could be indistinctly felt.

Operation March 1, 1892.—The breast and several enlarged axillary glands and the fascia over the pectoral muscles were removed. The muscles themselves did not seem to be involved and were left. The patient made a prompt recovery.

On May 20, 1893, a small nodule that had recurred in the scar was excised.

glands were appreciable in the right axilla.

Second Operation, March 22, 1894.—Within the preceding month the sternal tumor had increased very much in size, and the woman finally consented to an operation, which I performed at this time, with the assistance of Dr. J. William White. There being two small nodules in the skin over the sternal swelling, an elliptical incision was made, including both of these nodules. Four or five deeper nodules were then perceived which had not been noticed through the skin. As

the sternum and also the cartilages of the second and third ribs, as well as the intercostal muscle between them, seemed to be involved, I removed both the cartilages and also the intercostal tissues down to the pleura. The internal mammary artery was divided and secured by a curved needle passing through the thinned wall of the pleural cavity. A considerable portion (about $1 \times 1\frac{1}{2}$ inches) of both the manubrium and the gladiolus was then removed by the double rongeur forceps until apparently healthy bone was reached. The right breast was then removed, together with a layer of the pectoral muscle and all of its fascia, and the right axilla cleaned out. At the end of the operation the woman was in a very precarious condition, but under stimulants and strychnin she revived. Her highest temperature only once exceeded 101° . During April her temperature again rose and remained for some time above and below 100° , but she finally made a good recovery. While I was away on my summer holiday I learned that the disease returned, and that she died in the following August.

Dr. Kyle made the following report on the specimen: "Sections showed all the tissue to be infiltrated (malignant). The periosteum was thickened and cancerous. Also there was a small piece of the intercostal tissue extending down to the pleura, which, while not so much thickened, showed evidence of malignancy. The section of the rib or cartilage showed infiltration only on the upper side, which extended to the inferior margin. The central portion showed no evidence of malignancy."

RESECTION OF THE STERNUM

for any cause, but especially for tumors, is rare. In 1859 Heyfelder³ was able to collect only twenty-five cases of resection for all causes from the time of Galen downward, and even of these six were superficial resections; and Steinheil⁴ states that, apart from the cases very briefly reported by Otis in the History of our

Civil War, there were only thirty-six authentic cases reported. Mynter later, in 1891,⁵ was able to find only two cases of resection for tumors besides his own. From various sources I have been able to collect in all seventeen cases, to which I have added the two cases reported in this paper, making a total of nineteen cases of resection of the sternum for tumors. I have excluded the superficial resections for exostosis, etc.; such as Weinlechner reports,⁶ in which a colloid sarcoma of the breast was removed, together with an ossifying enchondroma of the gladiolus, as only the superficial layers of the bone were resected. I have restricted myself to those cases in which the entire thickness of the bone was removed, in seventeen out of the nineteen cases for tumor of the sternum, and in two cases for the removal of retro-sternal fibroids.

More or less of the sternum has been removed for various purposes:

(1.) To obtain access to the great vessels in order to ligate them. Bardenheuer⁷ has advocated resection of the manubrium in cases in which it is impossible to ligate the subclavian or the innominate artery or veins at the usual points. This seems, I confess, a very heroic procedure. I do not know of any recorded case in which it has been necessary.

(2.) For fractures, and especially gunshot fracture of the sternum. The most extensive statistics are those of Otis,⁸ who records fifty-one cases, with a mortality of 18, or 35.3 per cent. He illustrates with an excellent chromo-lithograph⁹ a frightful wound of the sternum from canister, from which the patient recovered and lived many years. Through the wound the pulsation of the aorta could be plainly perceived. Otis refers also¹⁰ to the case of the son of the Viscount Montgomery, who was injured by a severe fall, and fractured the ribs on the left side. An immense abscess formed, and a

³ Annals of Surgery, XIII., 966.

⁴ Bericht der K. K. Kaiseranstalt Rudolph Stiftung, 1871, Wien, 1873, p. 24.

⁵ Deutsche medicin. Wochenschr., 1885, II., 688.

⁶ Medical and Surgical History of the War of the Rebellion, Surgical Volume, Part 1, pp. 486 and 571.

⁷ Op. Cit. Opposite page 486.

⁸ Op. Cit., p. 571.

³ Lehrbuch der Resektionen, p. 304.

⁴ Centralblatt f. Chirurgie, May 25, 1889.

large part of the chest-wall sloughed, so that the heart itself was exposed. The case is the more memorable from the fact that the young man was shown to Charles II. by Harvey, in order that the king could perceive the movements of the heart.

(3.) The sternum may be resected for caries as a result of tuberculous osteomyelitis, and occasionally, as in one of my own cases (not here reported), from typhoid osteomyelitis.

(4.) The sternum has been resected for tuberculous fungous inflammation of the articulation between the manubrium and the gladiolus. Yvert¹¹ reports one case and quotes a second.

(5.) It is sometimes necessary to resect the sternum on account of retro-sternal abscesses. These may arise in the neck, from the thyroid gland, laryngeal cartilages, etc., and work their way downwards into the anterior mediastinum behind the sternum. Sometimes they originate in inflammation of the sterno-clavicular articulation, as pointed out by Bardenheuer, the abscess rupturing posteriorly toward the mediastinum instead of anteriorly. Occasionally such an abscess originates from tuberculous or other inflammation of the bone itself, producing an abscess of the anterior mediastinum.

(6.) The resection is necessitated by tumors. These may be either retro-sternal tumors, such as fibromata, dermoids, or other forms of tumor; or they may arise in the sternum itself or at the inner end of the clavicle, and later may invade the sternum.

The cause of tumors of the sternum is usually unascertainable. Sometimes they are due to violence, especially if they be sarcomatous, as in one instance (Case XIII) in which the growth arose, apparently, from the injury done by a companion seizing the elbows of the patient and quickly approximating them behind the back. In another case, not treated by operation, it was ascribed to a heavy weight that struck the bone; in a third (Case XVII), to injury from a broom-handle.

Such tumors may be either primary or,

occasionally, secondary. In the latter case, they are usually secondary to carcinoma of the breast. I have now examined a great many cases, with a view of determining whether Mr. Snow's assertion is correct, that in most cases of carcinoma of the breast the sternum is tender at the junction of the manubrium and gladiolus from carcinomatous invasion of the bone. I confess that I have only very rarely found the bone involved. The second case related in this paper is an instance of this. I have also seen this sign in one case of atrophic scirrhus, in which no operation was performed. Most cases of carcinoma of the breast, however, seem to be free from such invasion.

The varieties of the tumors are as follows:

Of various forms of sarcoma, . . .	9
Chondroma,	2
Secondary carcinoma, gumma, fibroma, of each one,	3
Retro-sternal fibroma requiring resection,	2
Variety not stated,	3
Total,	19

Almost one-half, therefore, of such tumors are usually, as one would expect, sarcomata. Occasionally the tumor extends into the muscles as in the first of my own cases, in which there were nodules in the sterno-cleido-mastoid, and also in Case XIII of the table, in which recurrent chondromata appeared in the great pectoral.

Fortunately, adhesions to the retro-sternal tissues, and especially to the pleura and the pericardium, do not take place until late. These tissues are usually pushed before the tumor, and the tumor, therefore, if the operation be not delayed too long, may be separated from them with ease. In three instances (Cases II, III, IV) the adhesions were so intimate that the pleura or the pericardium, or even all three, were unavoidably torn during the operation. The effect of such a tear is much slighter than one would suppose. Ordinarily, it is believed that the lung collapses. This is true, to some extent, but in the case above alluded to, in which I resected part of the sternum and some

¹¹ *Revue de Chirurgie*, 1893, XIII, p. 32.

ribs on account of typhoid osteomyelitis, I unavoidably tore a hole in the pleura, which, at the end of the operation, was as large as a silver dollar, and not the least collapse of the lung took place. It rose and fell with every respiration, protruding from the wound during inspiration and receding during expiration. In Koenig's remarkable case (No. II of the table), in which both pleurae and the pericardium were torn, very little respiratory difficulty followed, and the only disturbance of function was a marked increase in the frequency of the pulse. Tearing is not, therefore, always the formidable accident that it has ordinarily been deemed.

The portions of the sternum involved by the tumor were as follows:

Manubrium,	5 times
Gladiolus,	9 "
Clavicle, including also the manubrium,	1 "
Retro-sternal tumors,	2 "

The portion involved in the resection was the manubrium, 14 times; the gladiolus, 12 times. The total (26) exceeds the number of cases (19), as in some of them the resection involved parts of both the manubrium and the gladiolus. No instance of tumor involving the ensiform cartilage was found, but Ashhurst¹² refers to the two well-known cases of Linoli and Rinonapoli, as well as a third case of his own, in which the ensiform was removed on account of uncontrollable vomiting apparently due to backward pressure of this part of the bone.

Women seem to be more subject to the tumors under consideration than men, as there are ten women and five men mentioned in my table. In the other cases the sex was not given. Age seems to exert little, if any, influence, as

Of 20 years and under there were 2 cases	
from 21 to 30	4 "
" 31 to 40	1 "
" 41 to 50	3 "
over 50	2 "
Total	12 "

the age not being given in the remaining cases (7).

As to symptoms, physical signs and diagnosis, little need be said, as the tumor is always evident. Usually there is but slight pain and slight tenderness, but little inconvenience from pressure, and the presence of the tumor seems to be the main diagnostic sign. The size will vary from small tumors, such as were present in both of my cases, to the size of a fetal head, or to one weighing twelve pounds, as in a case reported by Dudon, or the very large tumor of Weinlechner, a composite sternal and mammary tumor, which extended from the middle line to the axilla, and from the clavicle to the border of the ribs.

The prognosis, for immediate recovery at least, is good. In Heyfelder's twenty-five cases, none of which was operated on for tumors, only two died. In Otis' fifty-one cases, eighteen died. In the nineteen cases here reported, in the first case the final result was not stated; of the remaining eighteen, four died, a mortality of 22.2 per cent. This is the more remarkable in view of the extent of some of the operations, such as those of Koenig, Küster, Mynter, etc.

The chest necessarily becomes narrowed when any large portion of the sternum is resected, as is stated by Bardenheuer and Koenig, but this seems to result in relatively slight inconvenience, either as to respiration or from the loss of support of the arm. In my first case, in which one-third of the left clavicle and practically all of the manubrium were resected, the use of the left arm is quite as good as that of the right.

Operative Technic.—The only treatment for the tumors under consideration is removal. If they are benign it is well, if one can do so, to keep the periosteum, but in the majority of cases, and certainly in all malignant cases, the periosteum should be removed with the bone. Bardenheuer advocates, in certain cases, osteoplastic resection of the bone, and states that he has waited as long as eight days before replacing the temporarily displaced bone. Of course, this procedure would only be applicable to those cases in which either a retro-sternal tumor was removed, or a temporary resection would be resorted to in order to ligate the vessels.

¹² International Encyclopedia of Surgery, VII, 528.

The best incision, when it is practicable, consists in making a flap. Instead of this, however, the incision may be a **T**, an **L** or an **I** incision, being necessarily varied according to the circumstances of each case. In a good many cases, as in both of my own, the skin and soft parts in front of the bone must be sacrificed, because they are involved in the disease. When it is possible, at the conclusion of the operation, it is best to close the opening, either by sliding the flaps or otherwise, but in many cases this will be impossible, and, as in my first case, the cavity must fill by granulation-tissue. In some cases, as in my first case, in order to get free access to the bones, it is better to remove entirely the soft parts, laying bare the bones before their resection. This facilitates their resection very greatly, by getting out of the way the mass of the tumor.

After the incision has been made, the next step is the removal of the inner end of one or of both clavicles. The amount of this bone to be removed will depend, of course, upon how much is involved in the disease. If the disease be sternal alone, usually only the inner third of the clavicle need be removed. The next step is the resection of the ribs and their cartilages as close to the sternum as the circumstances of the case will allow. This will be followed by the division of the intercostal muscles and other tissues, great care being taken not to open the pleura or the pericardium, or to wound the internal mammary artery. Roulliès has shown¹³ that this artery runs at a distance from the edge of the sternum varying from five to sixteen millimeters; that its position is not alike on the two sides of the body in the same patient; and that the narrower the sternum the further away is the vessel. If wounded, it can be secured, as in my second case, with a ligature passed by a curved needle.

The sternum now being cut loose from the clavicle, and the cartilages of the ribs being divided, the sternum and the tumor are lifted by blunt hooks and separated from the retro-sternal tissues. This is best effected by blunt dis-

section, and in my first case I found that the finger was by far the best means by which this could be done. I was so fortunate as to be able to separate the manubrium from the tissues behind it, including the great vessels of the neck, without even seeing any of them except the left jugular vein in the neck. If adhesions exist between the pleura or the pericardium and the tumor great care must be taken to separate them without opening either of these cavities, if possible. As pointed out, especially by Koenig and Küster, an assistant's finger should follow the fingers of the surgeon with a pledget of gauze, so as to be ready instantly to stop any opening in either of these membranes. In the case of typhoid osteomyelitis before referred to, I occluded the opening in the pleura by a pledget of iodoform-gauze, suturing the flap of skin over this and allowing it to remain *in situ* for three or four days.

In some instances instead of a resection of the bone in its entirety the maneuver adopted by Mynter is the best, namely, to trephine the sternum at a given point and then with the double rongeur forceps, gouge, chisel or bone-pliers to remove the diseased portion piecemeal. Sometimes the saw can be used to advantage. As pointed out, especially by Bardenheuer, in cases of retro-sternal abscess, simple trephining is of little value. Such an abscess is likely to be very extensive on account of its spreading in the loose tissues behind the sternum and it will need complete and thorough drainage. After trephining, therefore, a large portion of the bone should be removed by the rongeur, gouge or chisel. Indeed, Bardenheuer states that in four cases he removed all the manubrium and gladiolus, with the costal cartilages and the inner ends of both clavicles, and in each case obtained recovery.

Beside the dangers to the pleura, pericardium and the internal mammary arteries, the great vessels at the base of the neck and top of the chest are, of course, the principal and most threatening. That they can be avoided is shown by the fact that in only one case (VI in the table) was any one of them torn. In this case, the internal jugular being torn, Barden-

¹³ Resection du Sternum, Thèse de Paris, 1888.

heuer tied the right innominate, subclavian, external and internal jugular veins, and the patient recovered. In addition to this, the remains of the thymus gland, and, as a distant but possible danger, the phrenic nerves should be remembered.

If the soft parts in front of the sternum have been resected, thus leaving a large, gaping wound, it is impossible after a certain time to avoid more or less suppuration from later infection during the gran-

ulating process. In my first case this was a very serious danger and the pus threatened to make widespread havoc behind the gladiolus, and I feared at one time would enter the left pleural cavity. I adopted, therefore, Cathcart's method of drainage, which answered admirably. The cavity was kept absolutely free from the accumulation of any fluid and a light packing of iodoform-gauze absorbed what little was left.

RESECTION OF THE STERNUM FOR TUMORS.

No.	REFERENCE.	SEX AND AGE.	NATURE OF TUMOR.	PARTS RESECTED.	COMPLICATIONS.	RESULT.	REMARKS.
1	Holden, British Med. JI. 1878, II., 358.	F. 52	Sarcoma of gladiolus.	Imperfect removal of tumor only to posterior surface of the bone.			The more successful methods of modern surgery were hardly then in vogue.
2	Koenig, Centralb. f. Chir., 1882, No. 42.	F. 30	Osteoid chondroma of gladiolus.	Part of manubrium, the gladiolus and the ribs from 2d downward.	Both pleurae and pericardium opened. Both internal mammaries tied.	Recovery. Died 2 years later from recurrence in lungs.	Only slight respiratory trouble; great frequency of pulse.
3	Küster, Berlin. klin. Woch., 1883, 127.	M. 30	Gumma of gladiolus.	Right half gladiolus and 3d and 4th ribs.	Left pleura opened.	Recovery.	
4	Pfeiffer, Beitrag. z. Kennt. d. Sternal Tumoren, Halle, 1884.	M. 45	Sarcoma of gladiolus.	Gladiolus and 2d, 3d and 4th ribs.	Right pleura opened and pericardium exposed.	Died on 6th day. Pericarditis, hemo-thorax and pleurisy. Fresh tubercles in lungs.	Other tumors found at autopsy in 4th rib, pelves, in aortic glands, liver and right kidney.
5	Bardenheuer, Deutsch. Med. Woch., 1885, XI, 688.	F. —	Fibroid of manubrium.	Manubrium, $\frac{3}{4}$ of clavicle, 2d and 3d ribs.		Recovery.	Tumor extended to larynx, gladiolus and both clavicles.
6	"	M. —	Sarcoma of clavicle	Manubrium, $\frac{3}{4}$ clavicle, 1st and 2d ribs.	Int. jugular torn; tied right innominate, subclavian, int. and ext. jugular veins.	"	
7	"	—		Manubrium.		"	No other details given.
8	"	—		"		Death.	"
9	"	—		"		"	"
10	"	F. —	Retrosternal fibroid.	Manubrium, part of gladiolus, 1st and 2d ribs, and inner end of clavicle.		Recovery.	
11	"	—	"	"		"	
12	Jaenel, Resectio Sterni, Inaug. Dissert. Erlangen, 1887.	F. 12	Sarcoma of manubrium.	Manubrium, 1st and 2d ribs.	Retro-sternal tissues involved, and cauterized with nitric acid and cautery.	"	No return after a year.
13	Dudon, JI. de Méd. de Bordeaux, June 1, 1890.	F. 28	Enchondroma of gladiolus.	Manubrium, part of gladiolus and 1st and 2d ribs.	Internal mammary exposed, but not injured; suppuration of wound.	"	Tumor first removed by operation 27 months before; three small nodules removed 8 months later from pectoral and sternocleido-mastoid; ascribed to injury from bringing elbows forcibly together behind her back.
14	Mezzoni (in Dudon's paper).	M. 55	Myxo-sarcoma of gladiolus.	Gladiolus, 2d, 3d and 4th ribs.	None.	Death on 5th day from pneumonia.	

RESECTION OF THE STERNUM FOR TUMORS—CONTINUED.

No.	REFERENCE.	SEX AND AGE.	NATURE OF TUMOR.	PARTS RESECTED.	COMPLICATIONS.	RESULT.	REMARKS.
15	Graves, Med. News, March 4, 1893, 241	F. 44	Sarcoma of gladiolus.	3 x 3½ in. gladiolus and 2d to 5th ribs.	"	Recovery.	Right breast removed for carcinoma 22 months before.
16	Doyen, Arch. Prov. de Chir. 1895, IV, 633.	M. 37	Sarcoma of manubrium.	Manubrium, part—both clavicle, and 1st rib.	"	"	Right and left brachiocephalic vein disclosed; lungs and heart seen, but neither pleura nor pericardium opened.
17	Mynter, Annals of Surgery, 1891, XIII, 96.	F. 20	Melano-sarcoma of gladiolus.	Gladiolus (6 sq. in.) from 3d nearly to 6th ribs, and 3d, 4th and 5th ribs	"	"	Weight between half and three quarters. Removed also glands from both axillæ and subclavian glands. Pericardium exposed; ascribed to injury from handle of broom. Dr. Mynter kindly writes me that patient died in Ireland about a year later, probably from recurrence.
18	Keen, Present paper.	F. 28	Sarcoma of manubrium and sternocleido-mastoid	Manubrium, ⅓ clavicle, 1st rib and ⅓ sternocleido-mastoid.	Suppuration of wound; drainage by Cathcart's method.	"	No recurrence after 15 months.
19	"	F. 44	Carcinoma of manubrium and gladiolus.	Part of the manubrium and the gladiolus and 2d and 3d ribs.	Carcinoma of both breasts.	"	Left breast removed March 1, 1891; recurrent module in scar May 20, 1893. Right breast and parts of sternum March 22, 1894. Recurrence and death August, 1894.