

ABDOMINO-MEDIASTINOTOMY*

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Incisions which transect the sternum were unpopular until a few years ago. It was sometimes necessary to split the upper part of the sternum vertically in operations on retrosternal thyroid enlargements and in operations on the large blood vessels of the superior mediastinum and on the thymus. With the development of open-heart surgery the vertical, transsternal incision became popular. Not only has this vertical, sternal-split incision given a good exposure of the heart and anterior mediastinum, but it has also shown that the divided sternum heals well.

Vertical splitting of the lower end of the sternum gives a good exposure of the under surface of the diaphragm and this extension of an abdominal incision was recommended by Wangensteen in 1952.¹ However, surgeons operating in the upper abdomen have often been reluctant to use this incision. Exposure of the upper surfaces of the liver and spleen and of the area of the oesophageal hiatus can be direct and easy if a few additional minutes are spent in opening the lower mediastinum by a vertical transsternal incision. This operative approach to the upper abdomen

is described in this paper, and it is shown that this is an incision that can be made with great benefit to the surgeon and without any harm to the patient.

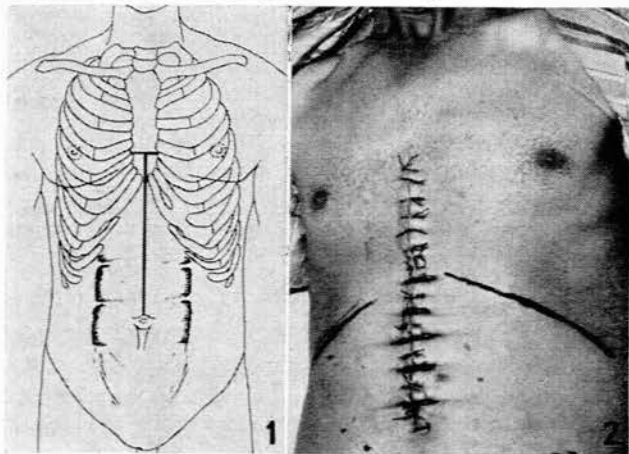


Fig. 1. The relation of the extended abdominal incision to the sternum and the lower ribs.

Fig. 2. The skin incision of an abdomino-mediastinotomy. The black lines indicate the lower costal margins.

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The Technique of Abdomino-mediastinotomy

The patient lies on his back and the skin is cleaned and draped from the nipples to below the umbilicus. A mid-line upper-abdominal incision is made and the abdomen is explored. If it is decided that splitting of the lower end of the sternum will make the operation easier, the abdominal incision is extended upwards in the mid-line. The incision is made down to the bone and its upper end stops at the level of the fifth costal cartilage, although it can be extended to the fourth. The origin of the diaphragm from the xiphoid cartilage is divided with scissors and a finger is inserted in the retrosternal space, separating the diaphragm and retrosternal tissue from the bone. A Schoemaker's sternum cutter or a Lebsche's sternum chisel and mallet are used to split the lower part of the bone vertically and in the midline. The periosteum is divided with the sternum without stripping it from the bone. The split is started from below and carried upwards to the height of the fifth intercostal space. In patients with a narrow subcostal angle, the sternal split may be made to the fourth space, and in those with a wide subcostal angle, to the sixth space. The bone-splitting incision is carried to one side or through the middle of the xiphoid. If the xiphoid process is long and slender it is removed before the bone is divided. After the sternum has been split a curved (Roberts) haemostat is pushed through the intercostal space next to the sternum so that it meets a finger introduced retrosternally from below. A Gigli saw is pulled through by the haemostat, so that it slides upwards in the bone incision. Half the sternum is then sawn through horizontally. Alternatively, an angled rib shears is used to divide the sternum horizontally at the upper end of the incision (Fig. 1). A self-retaining retractor (Finochietto), placed in the abdominal part of the wound, is used to separate the lower ends of the bone. The anterior fibres of the diaphragm are divided antero-posteriorly, as far as the pericardium. If the pericardium is accidentally opened, the hole is closed with a stitch. After division of the anterior fibres of the diaphragm the two segments of the sternum will open 2-2½ inches. If the left triangular ligament of the liver is now divided, a direct and good exposure of the oesophageal hiatus area and of the upper surfaces of the liver and spleen will be obtained.

The internal mammary artery lies half an inch to the lateral border of the sternum, and it will not be injured when the bone is transected horizontally, provided the dissection is done close to it. For this reason sawing the bone with a Gigli saw is preferred to cutting it with a rib shears. It is usually unnecessary to divide the sternum transversely to both sides, but when exposure of both sides of the upper abdomen is required, it may be done. The sternal-split incision can also be used with a right or left upper paramedian incision when the liver or spleen, respectively, has to be exposed.

On closing the abdomino-mediastinal incision the retractor is removed, and the divided ends of the sternum tend to fall together. Interrupted catgut sutures through the periosteum and the fascia are used to approximate the bone sides. These interrupted sutures will keep the bone segments firmly together, but if the upper transverse incision has been made through both sides of the sternum, it is advisable to use wire sutures passed through the bone.

The incision in the anterior part of the diaphragm is closed and the diaphragm is sewn to the retrosternal tissues and the upper part of the rectus abdominus muscle. This will close the retrosternal space. The abdominal incision is closed by a standard technique, and interrupted sutures are used for the skin over the sternum (Fig. 2).

Indications for the Abdomino-mediastinal Incision

1. Operations on the oesophageal hiatus are made easier since the hiatus lies directly underneath the operator. Strong retraction is not required and it is only necessary to hold the left lobe of the liver out of the way. This incision is therefore recommended for the following operations:

- (i) Repair of an oesophageal hiatus hernia through the abdomen.
- (ii) The Heller operation for achalasia of the oesophagus.
- (iii) Resection of a large gastric carcinoma requiring a near-total gastrectomy.
- (iv) Re-operation for stomal ulceration following a Billroth II gastrectomy.
- (v) A Billroth I gastrectomy for a gastric ulcer near the cardia.
- (vi) Resection of the vagus nerves.
- (vii) A total gastrectomy in an elderly patient or in a patient where the risk of opening the pleural cavity by a thoraco-abdominal incision is too great.

2. Operations on the liver, such as removing a hydatid cyst from the upper surface or doing a left hepatic lobectomy, are facilitated by the abdomino-mediastinal incision.

3. Removal of a large spleen which would otherwise require a thoraco-abdominal incision, can be done with comparative ease through this extended incision. Here a left paramedian incision with the mediastinal extension is preferred.

4. This incision is also recommended for passing a tape around the upper abdominal aorta in an emergency operation for a leaking abdominal aortic aneurysm.

5. When both adrenal glands have to be explored transperitoneally, for example in operating for Cushing's syndrome, it is an advantage to split the lower end of the sternum. This particularly facilitates exposure of the left adrenal gland. For exposure of the right gland the incision has to be extended below the umbilicus.

The only contraindication to this abdomino-mediastinal incision appears to be intra-abdominal sepsis, where contamination of the divided parts of the sternum may lead to an osteomyelitis.

The sternal-split incision described above has been used on 32 patients so far. The operations are listed in Table I.

TABLE I. TYPES OF OPERATIONS IN 32 PATIENTS

Type of operation	Number of patients operated on
Hiatus hernia repair	5
Total gastrectomy	2
Heller's operation for achalasia of the oesophagus	2
Billroth I gastrectomy	5
Re-operation for stomal ulceration	1
Hydatid cyst of the liver	2
Splenectomy	2
Vagotomy and pyloroplasty	12
Subtotal adrenalectomy	1
Total:	32

Complications

The complications that may arise from this incision are:

1. Opening of the pleural cavity. This occurred in one patient, where the hole was closed with a mattress suture. This is a complication that can usually be prevented by staying close to the sternum when the parasternal dissection through the intercostal space is made.

2. Injury to the internal mammary artery is unlikely since the artery runs half an inch from the lateral margin of the sternum. The artery was not injured in the operations reported in this paper.

3. Injury to the pericardium, which can be seen in the upper part of the wound, may result if division of the anterior fibres of the diaphragm is carried too far backwards. The pericardium was injured twice in the operations reported here. In both cases the small hole was easily seen and sutured.

4. Delayed or non-union of the sternum will follow osteomyelitis of this bone. For this reason careful aseptic surgery is essential, and this incision should not be used in the presence of intra-abdominal infection. Healing of the sternum is normally sound, whether the soft tissues are approximated by interrupted sutures or the bone by wire sutures. When the sternum is transected to both sides it is, however, advisable to fix the two parts of the bone by one or two wire sutures. Delayed union or non-union of the sternum or osteomyelitis of this bone did not occur in the patients reported here.

5. A retrosternal hernia may be a late complication if proper care is not taken to close the retrosternal space by suturing the sternal origin of the diaphragm to the soft tissues at the back of the sternum and to the rectus muscle.

6. Postoperative chest complications do not appear to be more frequent after this incision than after an upper abdominal incision. Serious chest complications were not seen in the patients reported in this paper. The patients did not have greater difficulty in deep breathing than

patients with only an upper abdominal incision. During the first few days after operation they complained of pain, especially in the abdominal part of the incision, but from the fourth to sixth day some pain and tenderness were present especially in the sternal part of the incision. The incision through the sternum sometimes remained tender to pressure for a few weeks. In one patient there was some movement on deep breathing between the lower sternal ends for 3 weeks after operation. Thereafter firm union took place.

CONCLUSION

The abdomino-mediastinal incision is an extended abdominal incision. As such it provides excellent exposure of the upper abdomen. It cannot take the place of a thoraco-abdominal incision and it does not give good access to the lower oesophagus. It makes operations on the liver and spleen and on the oesophageal hiatus easier and it does not have the same serious morbidity and mortality as a thoraco-abdominal incision, especially in old and ill patients or in patients with a diminished respiratory reserve. The splitting of the lower sternum prolongs the time required for the incision by about 5 minutes, but it makes the whole operation easier for the surgeon and therefore safer for the patient. It does not appear to carry a greater risk for the patient than a high abdominal incision.

SUMMARY

An upper mid-line or paramedian abdominal incision can be extended upwards into the mediastinum by splitting the lower part of the sternum. This can be done with minimal extra risk to the patient. Such an incision gives excellent access to the upper surfaces of the liver and spleen and to the area of the oesophageal hiatus. This incision has been carried out on 32 patients without any major complication.

REFERENCE

1. Wangenstein, O. H. (1952): *J. Amer. Med. Assoc.*, **149**, 18.