

South African Medical Journal

Suid-Afrikaanse Tydskrif vir Geneeskunde

P.O. Box 643, Cape Town

Posbus 643, Kaapstad

Cape Town, 18 June 1955
Weekly 2s. 6d.

Vol. 29 No. 25

Kaapstad, 18 Junie 1955
Weekliks 2s. 6d.

TENSION PNEUMOMEDIASTINUM ASSOCIATED WITH OPERATIONS ON THE NECK

JOHN TAIT RUSSELL, M.B., B.CH. (RAND), D.A. (ENG.), D.A. (IRE.)

Department of Anaesthesia, General Hospital, Johannesburg

In 1884 Champneys reported 82 cases of pneumomediastinum in association with tracheotomy operations. Since that time there have been reports from time to time on this condition, but it is one of comparative rarity and its incidence is apt to be forgotten by both surgeons and anaesthetists. Prompt action, when it arises, can be a life-saving measure.

Matthew Spence¹ reports a fatal case associated with positive-pressure anaesthesia in which pressure of over 20 mm. Hg was momentarily applied inadvertently. The mechanism in this type of case, however, is not the same as that associated with neck operations, although bilateral tension-pneumothorax may be the result in either case.

Bowden and Schweizer² in their admirable article discuss both types at length.

Anatomy

Some knowledge of the anatomy of the cervical fascia is essential to the understanding of the mechanism of the condition. Of the 3 layers of this fascia only the middle and the deep layers are involved.

Middle Layer (Pretracheal Fascia). This forms the carotid sheath laterally and extends to form the fascia covering the scalene muscles and merging with the fascia covering the levator scapulae and trapezius muscles. Inferiorly it extends into the mediastinum to blend with the fibrous pericardium. Thus a puncture in this fascia anywhere in the neck will provide a free passage into the mediastinum.

Deep Layer (Prevertebral Fascia). This fuses with the scalene fascia, ending laterally by fusing with the fascia covering the trapezius, levator scapulae and erector spinae muscles. It forms Sibson's fascia over the apex

of the pleura. Inferiorly it is continuous with the endothoracic fascia in the superior mediastinum.

Between the middle and deep layers of the cervical fascia in the mid-line is the space containing the trachea and oesophagus, which is an open passage to the superior mediastinum.

Mechanism. A wound in the pretracheal fascia frequently results in a 'uni-directional valve', air being sucked into the mediastinum during inspiration and being unable to escape during expiration. This phenomenon is particularly likely to occur if there is partial respiratory obstruction such as that caused by the kinking of an endotracheal tube. The increase in the mediastinal negative pressure results in a rapid increase in the volume of air being sucked into the mediastinum. As the pressure of the pneumomediastinum increases, air may track along the various tissue planes resulting in emphysema of the neck, face, axilla or thoracic wall. Bowden and Schweizer² report a case in which emphysema of the abdominal wall also resulted.

Unilateral and bilateral tension-pneumothorax may also eventuate from rupture of the mediastinal pleura. This appears to occur with greater facility in young children as their tissues are less able to withstand the increased pressure. Thus serious embarrassment of the action of the lungs results, the hypoxia and hypercapnoea rapidly becoming a matter of extreme urgency.

Diagnosis. If the condition is remembered, it should not present untoward difficulty. The first sign is usually laboured abdominal breathing, to all intents and purposes resembling the respiration of acute respiratory obstruction. There will be a discrepancy between the respiratory effort and the movements of the rebreathing

bag. Cyanosis may supervene, with signs of carbon-dioxide excess. If not treated energetically at this stage circulatory failure may develop. There are possibly two reasons for this. Firstly the increased mediastinal pressure may interfere with the venous return and, secondly, the marked degree of hypoxia and hypercapnoea undoubtedly brings about circulatory failure if allowed to persist for any length of time. The breath sounds are lessened and, if X-ray diagnosis is available, this will clinch the diagnosis. If, however, there should be any doubt, needling of the pleura in the mid-axillary line is not a procedure fraught with great danger, and may be a life-saving one.

Treatment. The treatment of choice is to puncture the pleura with a large needle and to withdraw as much air as possible by suction. As the pneumothorax is frequently bilateral it is advisable, especially in the absence of prompt radiographic investigation, to puncture both pleurae. Inflation of the lungs with oxygen should rapidly restore oxygenation and eliminate excess of carbon-dioxide. Subsequently the needles should always be attached to under-water drainage and not removed until it is certain that there will be no further lung collapse. The patient should be nursed at first in an oxygen tent.

CASE REPORT

D.G., a healthy female child of 14 months, was operated upon for the removal of a cystic hygroma of the neck. Premedication—atropine, gr. 1/150. Induction of anaesthetic with nitrous oxide, oxygen and ether; intubated through the mouth; maintenance with nitrous oxide, oxygen and minimal ether, with an Ayre's T-tube.

Operation continued uneventfully for 1½ hours, when partial respiratory obstruction developed due to interference with the catheter mount and the T-tube by the assistant's elbow. This was

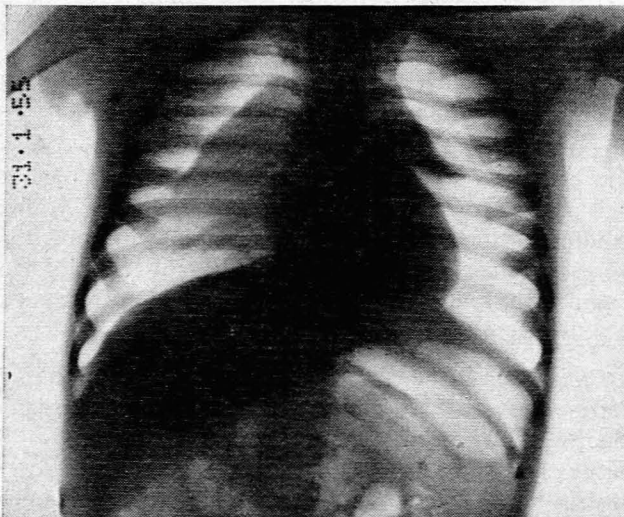


Fig. 1. X-ray showing considerable bilateral pneumothorax. Note bulging of right auricle due to interference with pulmonary circulation.

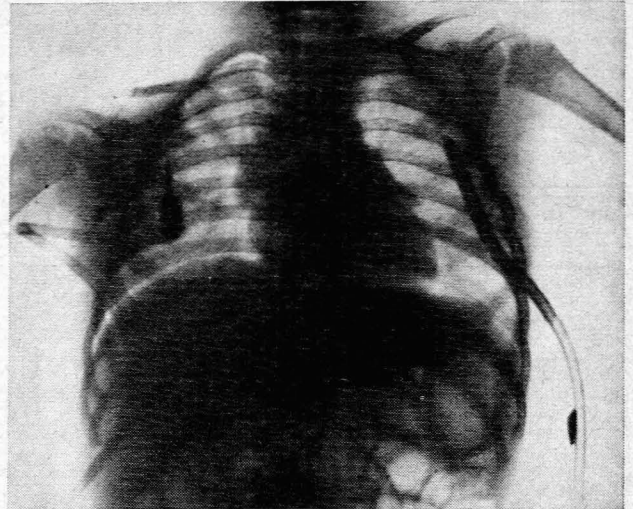


Fig. 2. Condition largely alleviated by bilateral under-water drainage of both pleural cavities.

rectified and the patient appeared to be in a satisfactory condition.

Fifteen minutes later further signs of what appeared to be partial respiratory obstruction developed, with some cyanosis and laboured abdominal breathing. On examination of the tubes no signs of obstruction or kinking could be found. The signs, as was seen a little later, were due to a bilateral tension-pneumothorax. Slight pressure was applied to the rebreathing bag on inspiration as the surgeon was completing the skin sutures. This possibly aggravated the condition instead of relieving it². The endotracheal tube was removed and the trachea well sucked out but this did not improve the patient's condition in any way. The child was cyanotic unless pure oxygen was administered.

On examination of the chest the breath sounds were faint. An X-ray taken within 10 minutes showed a bilateral pneumothorax with the lungs pushed up against the mediastinum. Although the X-ray plate was developed in 5 minutes more, the heart failed at the time that the plate arrived. The circulation was restored within 5 minutes; an incision was made in the 4th interspace on the left and the heart was grasped and squeezed about 60 times per minute³. The right pleura was punctured with a large needle attached to an under-water drain and the left chest closed, leaving an intercostal tube attached to an under-water drain. (Figs. 1 and 2). Spontaneous respiration commenced within a short time, but the child did not at any time become fully aware of her surroundings although she moved about and attempted to suck. She was nursed in an oxygen tent and the drains removed on the second day as respiration was satisfactory. Feeding was carried out through a stomach tube.

The patient continued to go downhill and died on the 5th day from irreversible cerebral damage that had been caused by the anoxia.

SUMMARY

The mechanism of tension-pneumomediastinum is discussed in association with operations on the neck. Its complications, especially that of tension-pneumothorax, are mentioned. Emphasis is on prompt and adequate treatment.

REFERENCES

1. Spence, M. (1955): *Anaesthesia*, **10**, 50.
2. Bowden, L. and Schweizer, O. (1950): *Surg. Gynec. Obstet.*, **91**, 81.
3. Vettes, K. Barbara et al., (1955): *Brit. J. Anaesth.*, **27**, 2.