

CASE REPORT

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Rib Spreader Laceration: A Confusing Artifact of Emergency Thoracotomy

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ABSTRACT: During emergency thoracotomy, an artifactual injury complex consisting of laceration, abrasion, and, rarely, contusion may be formed by application of a surgical instrument called a *rib spreader*. Six cases demonstrating this confusing injury are presented, and its formation is discussed.

KEYWORDS: pathology and biology, rib spreader, thoracotomy, injuries, artifacts

Artifactual injuries and changes of the postmortem interval may lead to interpretive problems for the forensic pathologist. Similarly, iatrogenic trauma of the perimortem interval may variously be confused with gunshot wounds, stab wounds, incised wounds, and blunt force injuries. The series of cases presented here delineates a patterned laceration, often with concomitant abrasions and contusions, caused by a surgical instrument called a *rib spreader* or *chest splitter*.

The instrument responsible for these injuries is applied during thoracotomy (or sternotomy) for the purpose of spreading the ribs or sternum to permit access to the thoracic contents. Injuries related to use of the rib spreader are seen primarily in emergency surgery where haste in application leads to trauma. The device consists of two opposing blades, one of which is fixed at a right angle to a bar containing evenly spaced teeth along one surface. The other blade is also oriented at a right angle to the bar, but moves freely along it with a ratchet device to maintain tension between the blades. Movement of the adjustable blade is effected by turning a thumbscrew or hinged handle attached to the ratchet device, thereby moving the adjustable blade back and forth along the toothed bar. Several different designs of rib spreader are available, including Finochietto, Burford-Finochietto, Haight, Harken, Tuffier, and Miltex; these vary in respect to blade design, pattern of teeth, and type of ratchet device. Two types of this instrument are shown in Figs. 1 to 4.

In the cases in this series, the rib spreader was used as part of a resuscitation attempt for

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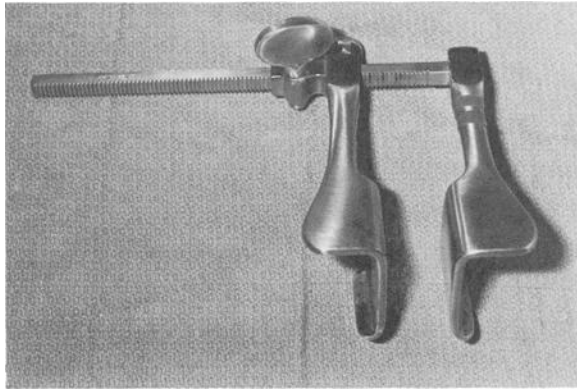


FIG. 1—Rib spreader of Tuffier design with thumbscrew type of ratchet device.

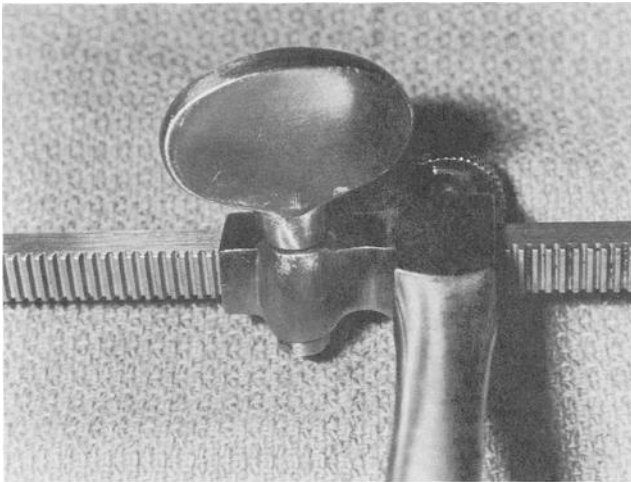


FIG. 2—View of ratchet device of instrument shown in Fig. 1. Note thumbscrew and pattern of teeth.

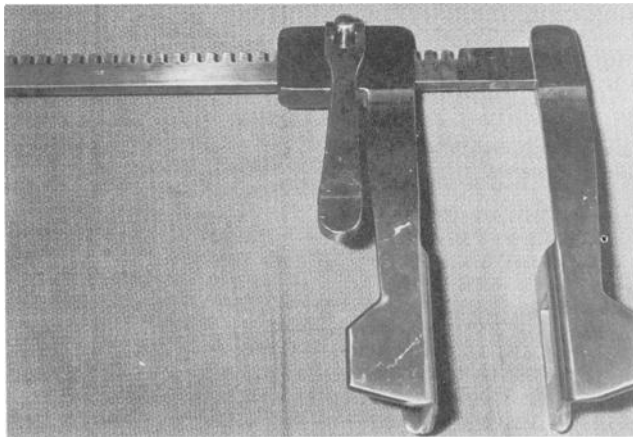


FIG. 3—Rib spreader of Finochietto design with hinged-handle type of ratchet device.

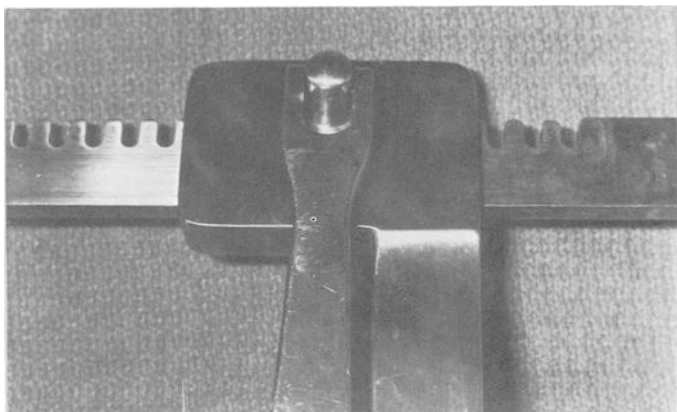


FIG. 4—View of ratchet device of instrument shown in Fig. 3. Note hinged handle and pattern of teeth.

exsanguinating cardiac arrest (five cases) or drowning (one case). The cases were distributed among three hospitals, indicating that the injury is related to instrument design and not to hospital technique. During application of the instrument, the patient is partially covered with surgical drapes, but no skin towels are used; the skin around the proposed incision is accessible and in proximity to the ratchet device on the rib spreader during formation of the injury.

Case Material

Case 1

During a robbery, a 58-year-old black male was shot in the abdomen and pelvis with perforation of right external iliac artery, jejunum, and ileum; a left thoracotomy was performed in the fifth intercostal space.

At autopsy, a teardrop-shaped laceration was noted on the skin surface of the inferolateral left chest (Fig. 5); it measured 1.3 by 1.3 cm ($\frac{1}{2}$ in. by $\frac{1}{2}$ in.). Projecting from the inferior margin was an 0.8-cm ($\frac{5}{16}$ -in.) skin tag bearing parallel, horizontally oriented linear abrasions.

Case 2

During a robbery, a 39-year-old black male was shot several times, involving liver, mesentery, inferior vena cava, and right common iliac artery. A thoracotomy was performed in the left fourth intercostal space.

At autopsy, a teardrop-shaped laceration was noted on the skin surface of the anterior left upper arm (Fig. 6); it measured 2.5 by 1.3 cm (1 in. by $\frac{1}{2}$ in.). On the superomedial margin, a tag of skin measuring 1 cm ($\frac{3}{8}$ in.) in length was noted with multiple parallel linear abrasions oriented horizontally.

Case 3

A 33-year-old heroin addict was shot in the chest during a drug purchase with perforation of right and left lungs and aorta. A thoracotomy incision was made in the left third intercostal space.

An ovoid laceration measuring 3.2 by 1.9 cm ($1\frac{1}{4}$ in. by $\frac{3}{4}$ in.) was noted at autopsy on the anterior surface of the left upper arm (Fig. 7). A skin tag measuring 1.2 cm ($\frac{1}{2}$ in.) pro-

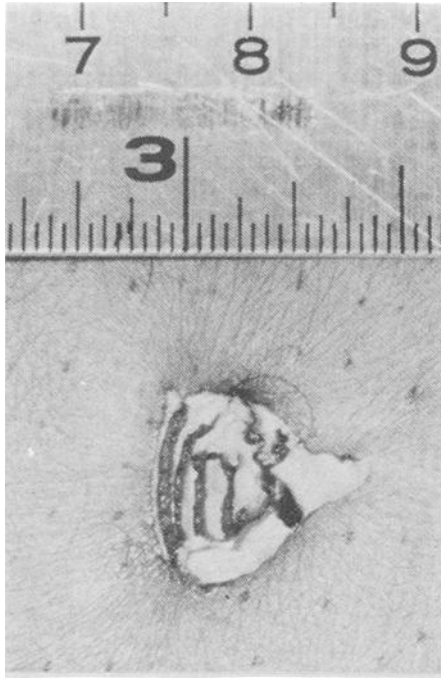


FIG. 5—Laceration of skin of inferolateral left chest. Note parallel linear abrasions from tooth pattern of rib spreader. (Case 81-10-837.)

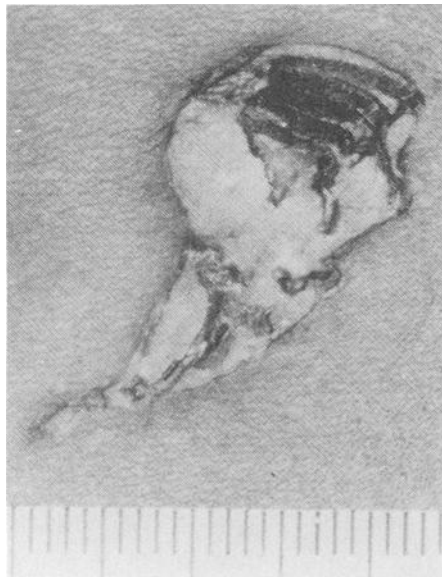


FIG. 6—Laceration of skin of anterior left arm. Note parallel linear abrasions from tooth pattern of rib spreader. Each division on the scale represents 1 mm. (Case 81-08-623.)

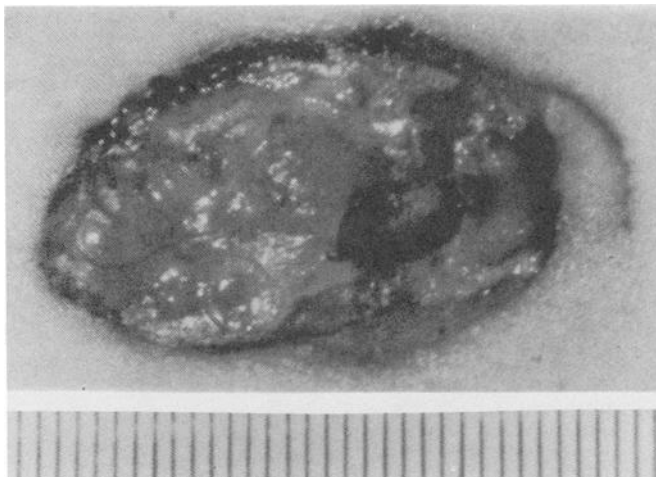


FIG. 7—Laceration of skin of anterior left upper arm. Note skin tag projecting into the laceration as well as the linear abrasion of the skin on the extreme right of the photograph. Each division of the scale represents 1 mm. (Case 81-01-080.)

jected into the wound from the superior margin; there was also a superficial linear semicircular abrasion extending from the superior margin onto the surrounding skin.

Case 4

During a robbery, a 28-year-old white male received a gunshot wound to the back, penetrating the chest with injury to the aorta and heart. A thoracotomy was performed in the left fifth intercostal space, followed by median sternotomy.

Multiple injuries were noted at autopsy involving the skin of the lateral right pectoral region in association with the sternotomy incision. There was a circular laceration measuring 1.2 cm ($\frac{1}{2}$ in.) in diameter with a 1-cm ($\frac{3}{8}$ -in.) skin tag projecting into the wound from its lateral margin, and a superficial linear semicircular abrasion extending from the inferolateral margin onto the surrounding skin. Located medial to this wound was a second, smaller 1-cm ($\frac{3}{8}$ -in.) ovoid laceration; these wounds are shown in Fig. 8. In addition, there were two faint parallel linear contusions measuring 4.4 cm ($1\frac{3}{4}$ in.) in length and separated by 1.9 cm ($\frac{3}{4}$ in.) that were oriented horizontally and extending laterally from the lacerations; these presumably were formed by pressure of the rib spreader bar against the skin surface.

Case 5

A 66-year-old white female was shot in the abdomen during a robbery with injury of the jejunum, mesentery, and left femoral artery and hemoperitoneum totalling 1200 mL. A thoracotomy was performed in the left fourth intercostal space.

At autopsy, a triangular laceration measuring 2.9 by 1.2 cm ($1\frac{1}{8}$ in. by $\frac{1}{2}$ in.) was noted (Fig. 9) on the skin of the upper left pectoral region near the left axilla. Projecting into the wound from the medial margin was a skin tag measuring 0.8 cm ($\frac{5}{16}$ in.) as well as a superficial linear semicircular abrasion of skin on the medial edge measuring 1 cm ($\frac{3}{8}$ in.).



FIG. 8—Lacerations of skin of lateral right pectoral region. Note skin tag projecting into the larger laceration as well as the linear abrasion of the skin toward the lower right of the photograph. Each division of the scale represents 1 mm. (Case 81-11-889.)

Case 6

A 35-year-old black male committed suicide by jumping into a river (Case 81-09-749). Part of the resuscitation included a left thoracotomy.

A teardrop-shaped laceration of the skin surface of the upper left pectoral region near the axilla was noted at autopsy; it measured 2.1 by 0.6 cm ($1\frac{3}{16}$ in. by $\frac{9}{16}$ in.) and had two 0.6-cm ($\frac{1}{4}$ -in.) horizontally oriented skin tags projecting into the wound from its inferomedial border.

Discussion

These six cases demonstrate patients who underwent emergency thoracotomy including median sternotomy during which a rib spreader or chest splitter was applied. All had an iatrogenic, artifactual patterned injury with elements of laceration, abrasion, and, rarely, contusion. A triad of observations—association with a surgical incision, anatomic location, and pattern of injury—permit the correct interpretation of these artifacts of resuscitation.

The anatomic locations of the injuries in the six cases studied are shown in Fig. 10. Most of the wounds are noted on the left side of the chest, since a left thoracotomy is commonly used for emergency access to the heart. The one wound on the right side of the chest is related to median sternotomy. Presumably, in situations where an emergency right thoracotomy is performed, the same injury could result; however, a left-sided lesion is probably more likely to form, since the anterior axillary fold crosses the ratchet line.

The basic element of each wound is a laceration that results when a portion of skin becomes entrapped in the ratchet device of the rib spreader. The wound is located at considerable



FIG. 9—Laceration of skin of upper left pectoral region near the axilla. Note darkened, dried skin tag and semicircular abrasion on the edge of the wound at the top of the photograph. (Case 81-05-405.)

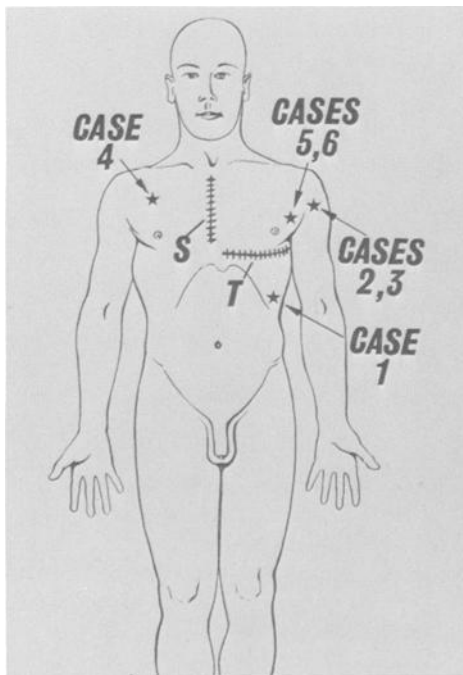


FIG. 10—Diagram showing the location of the injuries in the cases presented. S = sternotomy incision; T = thoracotomy incision.

distance from the associated surgical incision. In addition, there may be a group of linear parallel abrasions from the teeth of the rib spreader bar (Cases 1 and 2), skin tags projecting into the laceration (all cases), semicircular abrasion of nearby skin (Cases 3, 4, 5, and 6), and an accessory laceration (Case 4). There were also contusions in Case 4, which were linear and parallel, presumably formed by the lateral margins of the toothed rib spreader bar.

The rib spreader injury differs from the trauma caused by towel clamps or forceps; such injuries may include superficial puncture wounds or abrasion-contusions. More importantly, the wound must be differentiated from stab wounds, incised wounds, gunshot wounds, and blunt force injury.

Conclusions

Patterned complex wounds that include elements of laceration, abrasion, and contusion are seen on the skin surface of the thorax and upper extremities in association with emergency thoracotomy and median sternotomy incisions. They can be recognized as artifactual injuries on the basis of a triad including association with a surgical incision, anatomic location, and wound configuration. They must not be misinterpreted as stab wounds, incised wounds, or gunshot wounds, or as evidence of blunt force injury.

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