Clinical Records

Laryngeal Trauma

By John Duff (Bridgetown, Barbados)

Injuries to the laryngeal skeleton are increasing, due mainly to the rising incidence of high-speed motor vehicle accidents, as evidenced by reference to any daily newspaper. After anatomical disruption, healing occurs with severe fibrosis, tending to contract the airway in the vicinity of the damage. The treatment of an established stenosis of the airway is difficult and often hazardous and recent work on this problem has emphasized that prevention is easier than cure (Fitz-Hugh *et al.*, 1962). The three cases to be described were seen during the course of a year's practice in an island community of just under a quarter of a million people and include a bicycle accident, an attack by a lunatic and a gunshot wound.

Case Reports

Case No. 1.

C.H., a male stevedore aged 55, was admitted to the casualty department of the Queen Elizabeth Hospital on 20 November 1965, after having fallen from his bicycle in trying to avoid a motor vehicle. He was seen by the casualty officer whose immediate concern was the obvious difficulty in breathing. The patient intimated that his throat was painful and between stridulous gasps gave a few details of his history in a faint and scratchy voice.

On examination, there was palpable subcutaneous cervical emphysema and the laryngeal landmarks were obscured by swelling. The patient was cyanosed and both inspiration and expiration extremely laboured. There were no other signs of associated injury. The anaesthetist was immediately summoned and an endotracheal tube was passed under pentothal and scoline anaesthesia through oedematous and haemorrhagic cords. There was an immediate improvement in the patient's colour and pulse and he was transferred to the operating theatre.

A diagnosis of laryngeal injury having been made, direct laryngoscopy was performed followed by exploration of the neck through a midline laryngofissure incision. After oxygen saturation and removal of the tube, direct laryngoscopy revealed gross oedema of the true and false cords and a jagged fragment of tissue lying in the subglottic region. There was much blood and blood clot in the larynx, but owing to anaesthetic paralysis it was impossible to assess cord mobility. The tube was replaced after suction of blood and clot and the neck opened in the midline.

Fig. 1 shows the salient damage in diagrammatic form. It appears to coincide

https://doi.org/10.1017/S0022215100069516 Published online by Cambridge University Press

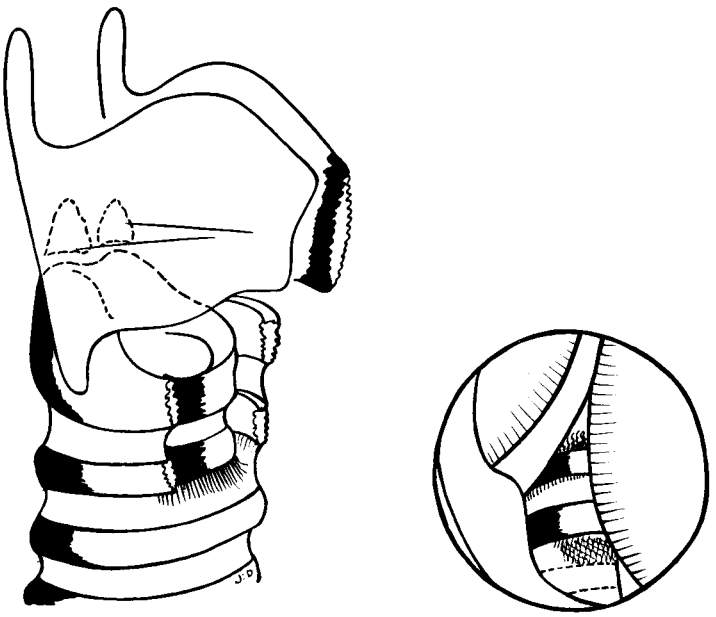


FIG. 1.
Damage to larynx in Case 1.

with Ogura's group of subglottic crushing injury (Ogura and Powers, 1964). The fragment seen on direct laryngoscopy was the upper edge of the cricoid cartilage and first tracheal ring, avulsed and lying in the subglottis and attached precariously by a portion of intertracheal membrane to the second tracheal ring. The alae of the thyroid cartilage were separated by complete fracture of the symphysis the left ala overlying and anterior to the right and on lifting it up, the interior of the larynx was seen (i.e. a traumatic laryngo-fissure). A low tracheostomy was established and the orotracheal tube removed.

A stout rubber tube of outside diameter 12 mm. was inserted through the laryngo-fissure and sutured in place with stainless steel sutures transfixing the neck, to be tied over the final dressing. The tube extended from the top of the tracheostomy tube to about 1 in. above the glottis.

Repair consisted of approximating all mucous membrane around the fragment to a normal anatomical configuration with a 4-zero atraumatic catgut. Superiorly this included the cricothyroid membrane. The membrane inside the thyroid cartilage was similarly dealt with and the fractured alae were reduced and held in position with 2-zero chromic catgut transfixing the cartilage. The neck was sutured routinely and a suction drain inserted. Post-operatively the patient received antibiotics and cortisone 25 mgm. daily for 3 days, reducing via 20, 15, 10 and maintaining on 5 mgm. daily for 2 weeks, in an empirical endeavour to minimize fibrous replacement. Feeding was intravenous for the first 48 hours, thereafter a soft diet was given by mouth. The upward projection of the mould caused aspiration of food and saliva on swallowing and a flush

https://doi.org/10.1017/S0022215100069516 Published online by Cambridge University Press

spigot was inserted in the upper end of the tube. Aspiration ceased and deglutition was satisfactory.

The intralaryngeal tube was removed 4 weeks after placement when a good lumen was observed from the supraglottis to the tracheostomy tube. The tracheostomy tube was removed 4 days later and the patient made an uneventful recovery.

Follow up: 14 days after decanulation, indirect laryngoscopy showed an oedematous right false cord, which in phonation appeared to meet the left true cord. The right true cord was not seen. The voice was harsh, but of good volume. There had been no respiratory distress.

1 month later: Both cords visible and meeting. A mucous polyp was seen on the edge of the right false cord. There was a small granulation in the anterior commissure. The axis of the larynx was rotated to the patient's right. The voice was much smoother and of excellent volume.

2 months later: Returned to work as a stevedore and is managing heavy lifting. The larynx slanted as before with a short left true cord. Both cords moving well. No polyp or granulation visible.

Last seen 15 months after the accident. Excellent voice and regards himself as quite without residual disability.

Case No. 2.

G.S., male aged 67, was admitted to casualty having been struck about the face and neck by a lunatic with a cricket bat. Numerous severe gashes were present on the face, the mandible was fractured in three places; there was subcutaneous cervical emphysema and the laryngeal landmarks were obscured by oedema. The breathing was distressed and difficult. Anaesthesia was immediately administered and the airway maintained by cuffed endotracheal tube.

The E.N.T. Department was summoned due to difficulties experienced in finding the trachea for tracheostomy. The neck contained abundant haematoma and the landmarks were difficult to recognize.

Full exploration of the laryngeal skeleton was undertaken by extending the vertical incision. Separation of the thyroid alae had occurred at the symphysis, with the right ala overlying the left with severe tearing of the soft tissues to accommodate the deformity. Low tracheostomy was established and accurate apposition of laryngeal mucous membrane and thyroid cartilage effected as in the previous case. A rubber tube similar to Case No. 1 was inserted, but cut off shorter, just above the false cords.

The facial lacerations were closed, the fracture of the mandibular ramus wired by open reduction (the patient was edentulous) and the bilateral fractures of the condyles left alone.

Post-operative course: Intravenous feeding was maintained for 48 hours and antibiotics and cortisone given as in Case No. 1. After 48 hours, oral feeding was attempted but the patient refused to swallow, as he complained of pain and inability to make swallowing movements. Nasogastric feeding was started and maintained with difficulty. Throughout the post-operative month, the patient was belligerent and unco-operative and the entire ward staff was tried to the limits of tolerance. It was a perpetual battle to keep the

https://doi.org/10.1017/S0022215100069516 Published online by Cambridge University Press

feeding tube down and he refused to attempt to swallow. Fluids, however, would go down satisfactorily without aspiration if he were coerced.

Three weeks following insertion, the intralaryngeal and tracheostomy tubes were removed. It was thought that this was too early, but the patient refused to put up with the *status quo* and insisted that all the tubes be removed. An adequate glottic lumen was seen and both cords were moving normally. Swallowing was obviously easier and the patient began reluctantly to take by mouth. Thereafter the recovery was slow but uneventful. The voice was husky, but of good volume. Throughout this time, attempts had been made to make him exercise the jaws, on account of his bilateral condylar fractures. He failed to co-operate. Post-operatively, he could open his mouth about an inch. Mirror examination was therefore impossible. He was last seen 6 months following the accident, when he had a good husky voice and no respiratory embarrassment on exertion. Movement at the temporomandibular joints was still limited.

At the time of writing (one year from last visit) he still fails to return for check-up. As this Department is the only one in a small community, it is assumed that his airway is adequate or that he has passed on from other causes.

Case No. 3.

D.C., a male aged 19, was admitted to Casualty with a gunshot wound of the neck. Examination revealed an anxious but unshocked patient in no respiratory distress, with a hoarse voice, oozing from two puncture wounds symmetrically placed $2\frac{1}{2}$ inches below the earlobe overlying the sternomastoid muscles and with a dark powder stain around the left neck wound. There was surgical emphysema of the neck.

The excellent general condition of the patient suggested that the great vessels had been spared, but the possible damage made urgent exploration mandatory. After preoxygenation and induction with pentothal and scoline, direct laryngoscopy revealed puncture wounds in the subglottic mucous membrane, indicating a missile track across the subglottic larynx. There was early cord oedema and haemorrhagic discoloration with oedema of the left ary-epiglottic fold. Low tracheostomy was performed and the laryngeal skeleton explored by way of a U incision connecting and excising the skin puncture wounds. A probe, passed through the superficial hole, grated on cartilage but failed to transfix the neck. (The bullet presumably had been deflected in its passage.) No fragmentation of the laryngeal skeleton was noted, the bullet appeared to have passed through both cricothyroid membranes and the cricothyroid muscle overlying. The wound was closed with drainage.

Post-operatively, recovery under antibiotic cover was uneventful and the tracheostomy tube was removed on the seventh post-operative day when indirect laryngoscopy showed a normal glottis. Phonation and respiration were normal.

Follow up over the next 6 months showed a normally functional larynx and a nice pliant scar.

Discussion

The establishment of an adequate airway is obviously an urgent prerequisite in salvaging these very dangerous injuries. This must depend on the

https://doi.org/10.1017/S0022215100069516 Published online by Cambridge University Press

efficient organization of the Casualty Department. Once the airway is ensured, by endotracheal intubation in the first place and subsequently by low tracheostomy, the immediate threat to life is passed. Fractures of the larynx all too often condemn the patient to the consequences of airway stricture. It would appear that immediate exploration and accurate reconstitution of the anatomy gives the patient the best possible chance of adequate phonation and air exchange. Fitz-Hugh *et al.* (1962) draw attention to the importance of early recognition of laryngeal damage and it is further emphasized by Ogura and Powers (1964) who report three functionally excellent results of surgery undertaken within three days of injury. The physical sign almost pathognomonic of laryngeal disruption is subcutaneous cervical emphysema. This finding taken in conjunction with respiratory distress and voice change makes a full inspection of the larynx under general anaesthesia obligatory. All three cases in the author's series had emphysema, but the third case had no anatomical disruption. The full exploration of the skeleton, however, is felt to have been fully justified, to "make sure". If there is haematoma and emphysema it may be quite impossible, accurately to delineate the landmarks of the larynx. An extension from the tracheostomy incision, which most laryngeal injuries require, is a relatively small procedure. At open operation an accurate assessment can be made and the anatomy reconstituted. Only if this is done before fibrosis and scarring are established can an adequate airway *de primo* be hoped for. Laryngoscopy and bronchoscopy are undoubtedly extremely helpful in many cases, but oedema may be so marked as to obscure completely the laryngeal inlet, making any evaluation of skeletal integrity unreliable.

Aspiration through a patent mould is troublesome and further cases will be treated with Stent rather than a tube. Middleton (1966) recommends Stent for Ogura's procedure for chronic subglottic stenosis, as does Ogura himself, but appears satisfied with a portex tube for other situations, despite reporting aspiration in two patients.

There appears to be lack of uniformity of opinion as to how long the mould should remain *in situ*. The two reported cases did well with 4 weeks and 3 weeks respectively. Ogura and Powers state that 3 weeks is long enough. A compromise has to be found between the increased risk of infection, further fibrosis, and discomfort with protracted intubation and the minimum time for firm union of fragments in an anatomical position. The use of steroids is empirical. Their use has been defended as an extension of the treatment of oesophageal trauma.

Summary

The problem of laryngeal trauma is briefly reviewed.

Three surviving cases of laryngeal trauma are presented who had no post-injury phonation or breathing difficulty.

The advisability of urgent open exploration and anatomical reconstitution is stressed especially in cases presenting with subcutaneous cervical emphysema.

Acknowledgment

I am grateful to Miss Betty Underhill, Casualty Surgeon, for referring these cases. She is to be congratulated on diagnosing them swiftly enough for endotracheal intubation to have been life saving.

https://doi.org/10.1017/S0022215100069516 Published online by Cambridge University Press

John Duff

REFERENCES

FITZ-HUGH, G. S., WALLENBORN, W. M., and MCGOVERN, F. (1962) *Ann. Otol.* (*St. Louis*), **71**, 419.
OGURA, J. H., and POWERS, W. E. (1964) *Laryngoscope* (*St. Louis*), **74**, 1081.
MIDDLETON, P. (1966) *Ann. Otol.* (*St. Louis*), **75**, 139.

Box 419,
Bryanston,
Transvaal,
South Africa.

https://doi.org/10.1017/S0022215100069516 Published online by Cambridge University Press