

Pharyngeal trauma in children – accidental and otherwise

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Abstract

Pharyngeal perforation is an uncommon injury in children. Most reported cases to date have been secondary to instrumentation or penetrating wounds. Laceration to the pharyngeal wall may introduce air, secretions and bacteria into the parapharyngeal space and mediastinum and consequently has potentially life-threatening sequelae. The management of these injuries is controversial. We present a series of four children who suffered pharyngeal trauma, accidentally and otherwise, and discuss their management.

We recommend a high index of suspicion of pharyngeal injury in all cases of oropharyngeal trauma and overnight admission to hospital for observation until an accurate diagnosis has been established. Non-accidental injury of the child must be seriously considered in all cases.

Key words: Pharynx; Wounds and injuries; Child

Introduction

Perforation of the pharynx is an uncommon injury with a variety of aetiologies. Most reported cases to date have been secondary to instrumentation or penetrating wounds (Hagan, 1983). The anatomical weakness of the hypopharyngeal-oesophageal junction predisposes this area to perforation.

Trauma to the pharynx may be secondary to endotracheal intubation and it is a recognized complication of induction of anaesthesia. Once a tear has been made in this way, extension may occur if the endotracheal cuff is inflated against the torn mucosa. Trauma to the hypopharynx may also be caused by nasogastric tubes and suction catheters (Meyers, 1978). Other iatrogenic causes include: digital trauma during efforts at resuscitation and an obstetrician's fingers during a difficult delivery of an aftercoming head at a breech delivery (Tucker and Padula, 1968). Fliss described a series of children with oropharyngeal injury secondary to intra-oral lemonade bottle explosions (Efrati, 1992) and Hood (1957) reported a case caused by a fire extinguisher discharging suddenly into the patient's mouth.

Blunt trauma can result from acceleration-deceleration injuries, blows to the neck or strangulation (Dolgin *et al.*, 1992). Isolated perforation of the hypopharynx is rarely produced by blunt trauma, but the intact cartilaginous framework of the larynx may disguise a perforation.

Laceration of the oropharyngeal wall may induce dissection of air into the planes of the soft tissues of the neck and mediastinum, following the three compartments formed by the cervical fascias. Gravity and intermittent negative intrathoracic pressure

favour further propagation of gas into the mediastinum (Efrati, 1992). Explosive rupture of the pharynx produces contamination of these fascial planes by bacteria and pharyngeal secretions. Flora from the mouth gain entry onto the tissue planes directly, and via the lymphatics. Aerobic and anaerobic pathogens may propagate via sublingual, submandibular, parapharyngeal and retropharyngeal spaces to the sterile mediastinum (Efrati, 1992).

Penetrating trauma and the presence of a foreign body may lead to the formation of a retropharyngeal abscess. This can lead to sudden and fatal airway obstruction, aspiration of pus, mediastinitis, thrombosis of the internal jugular vein or erosion of a carotid artery.

Case reports

Case 1

A.H. was a seven-week-old girl, initially seen in the Accident and Emergency Department of the referring hospital, with difficulty in breathing and bleeding from the mouth.

The initial history, taken from the father, was that he had been carrying the child in his arms when he tripped and injured the baby's neck with the tip of his elbow. A.H. subsequently bled from the mouth, and so was taken immediately to casualty.

On presentation she was not in any apparent respiratory distress. Laryngoscopy was performed revealing what looked like a cyst in one vocal cord. She was admitted overnight for observation. A review after 12 hours revealed the development of a lump in the right anterior triangle of the neck, with

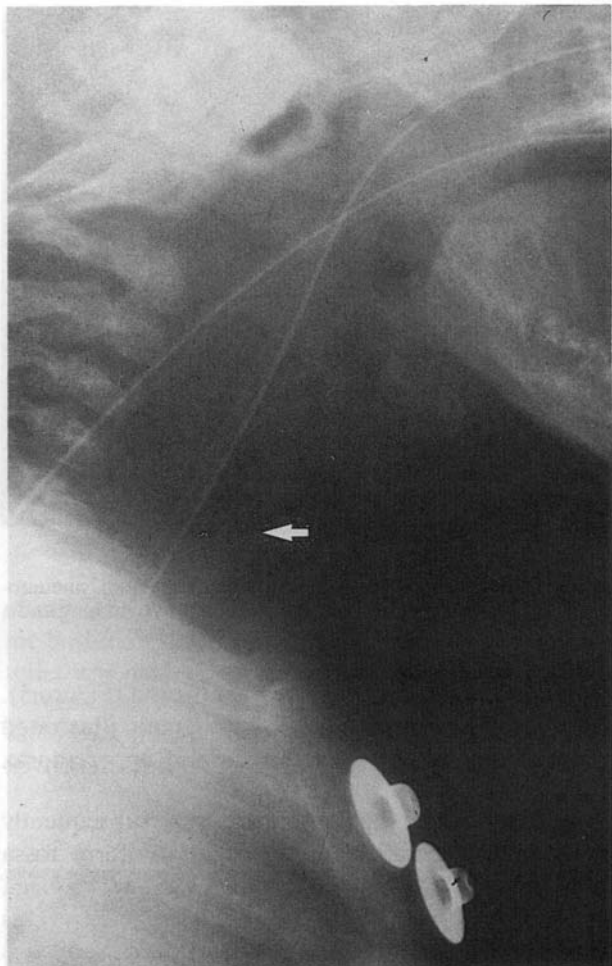


FIG. 1

Lateral neck radiograph of *Case 1* showing air in the soft tissues of the neck.

associated respiratory distress when the head was turned to the right. At this stage referral was made to Great Ormond Street Hospital for Children.

A further history, which had changed somewhat from the original, was taken from the father stating that he had tripped whilst climbing the stairs with the baby in his arms, and had partially crushed the baby's head in the crook of his arm, thus initiating bleeding.

Physical examination revealed a baby who was drooling and had no respiratory distress unless her head was turned to the right. There was a 2 by 2 cm, soft, fluctuant, deep-red swelling in the right anterior triangle of the neck. This was thought to be consistent with a haematoma. A torn upper gingival frenulum was also noted.

A skull radiograph accompanying the child from the referring hospital suggested a right parietal skull fracture. A subsequent computerized tomogram of the head and a full skeletal survey revealed no abnormality.

A lateral neck radiograph showed swelling and air in the retropharyngeal tissues (Figure 1). An ultrasound scan of the neck was performed, which surprisingly disclosed air within the neck lump, rather than blood as previously supposed. A barium

swallow then revealed a leak of contrast material into the parapharyngeal area (Figure 2).

A pharyngolaryngoscopy was carried out revealing a massive right hypopharyngeal wall laceration, extending from the inferior pole of the right tonsil to the apex of the pyriform fossa. In this cavity was packed approximately 20 ml of tissue paper (Figure 3), which after careful removal revealed an exposed carotid sheath (Figure 4).

Post-operatively, the child recovered well on a regime of nasogastric feeds and intravenous, broad spectrum antibiotics. A further examination of the pharynx under general anaesthesia after nine days showed a complete healing of the laceration.

As the injury was so unusual and suspicious in nature, and in view of the altered history from the father, social services were involved at an early stage. A criminal charge has since been placed.

Case 2

An eighteen-month-old boy, D.S., initially presented at his local Accident and Emergency Department (A&E) with bleeding from the mouth.

The history, from the father, was that the child was

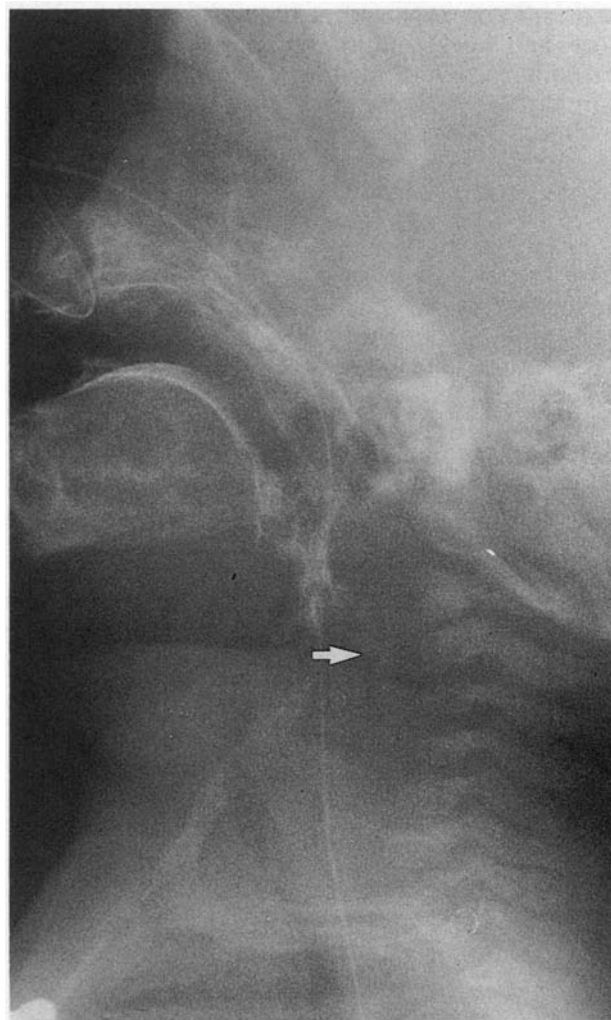


FIG. 2

Barium swallow radiograph of *Case 1*: contrast material is shown leaking into the parapharyngeal space.

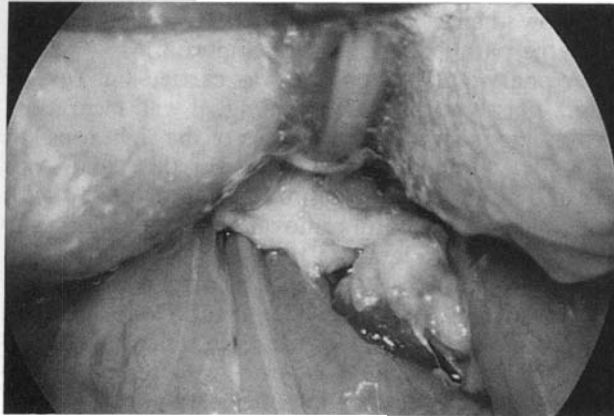


FIG. 3

View at pharyngoscopy of *Case 1*: tissue paper packed into laceration.

found gagging on his toothbrush, which was protruding from his mouth, the child having fallen over whilst cleaning his teeth. The brush was easily removed, but some bleeding was noted.

Nothing abnormal was found on examination and so the child was discharged home and allowed to eat. Regrettably, two hours later, the child awoke screaming in pain with a dramatic swelling of his face and neck and so he reattended the A&E Department. On arrival he was in obvious respiratory distress prompting an urgent pharyngeal examination under anaesthetic. After a difficult intubation, oedema of the palate and the left pyriform fossa was noted. Urgent referral to Great Ormond Street Hospital was then arranged.

On arrival the child was breathing spontaneously, with an endotracheal tube *in situ*. He was flushed and sweaty with a pyrexia of 39.5°C, tachycardia and tachypnoea. There was a marked swelling of the neck, more so on the right, which was obviously crepitant.

A chest X-ray displayed a pneumomediastinum, pneumopericardium, collapse and consolidation of

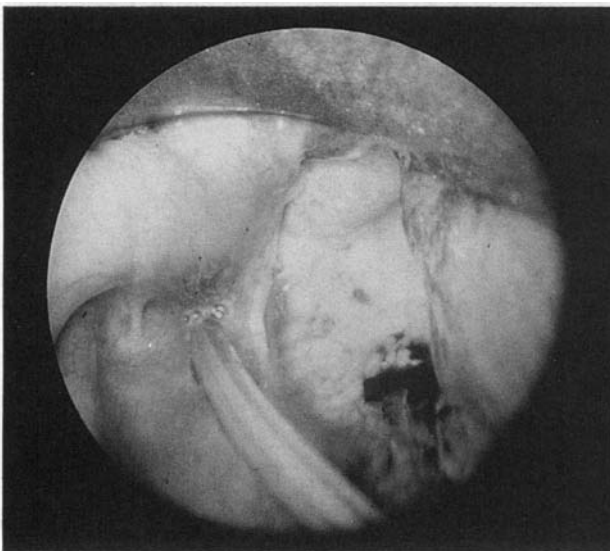


FIG. 4

View at pharyngoscopy of *Case 1*: after removal of foreign material shown in Figure 3.

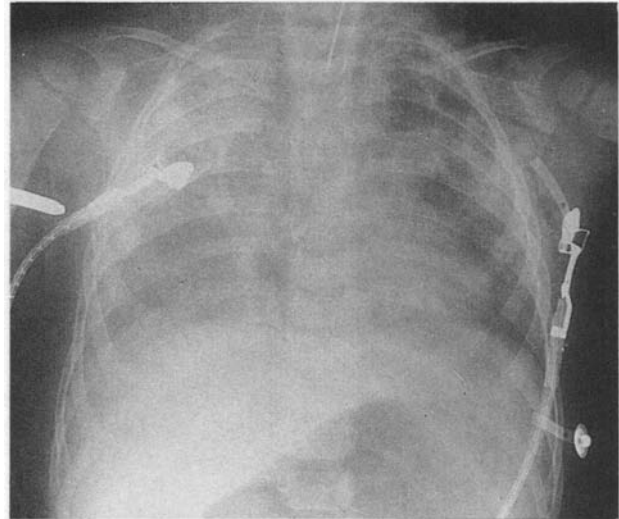


FIG. 5

Chest radiograph of *Case 2*: pneumomediastinum, pneumopericardium, collapse and consolidation of the right lung and a right pleural effusion.

the right lung and a right pleural effusion (Figure 5). The soft-tissue lateral neck radiograph illustrated surgical emphysema of the neck and upper thorax (Figure 6).

Urgent pharyngolaryngoscopy subsequently revealed a laceration in the right pyriform fossa containing food debris (Figure 7), and a neck exploration was immediately performed. This showed gross oedema and saliva in all tissue planes and tracking of food debris between the right carotid

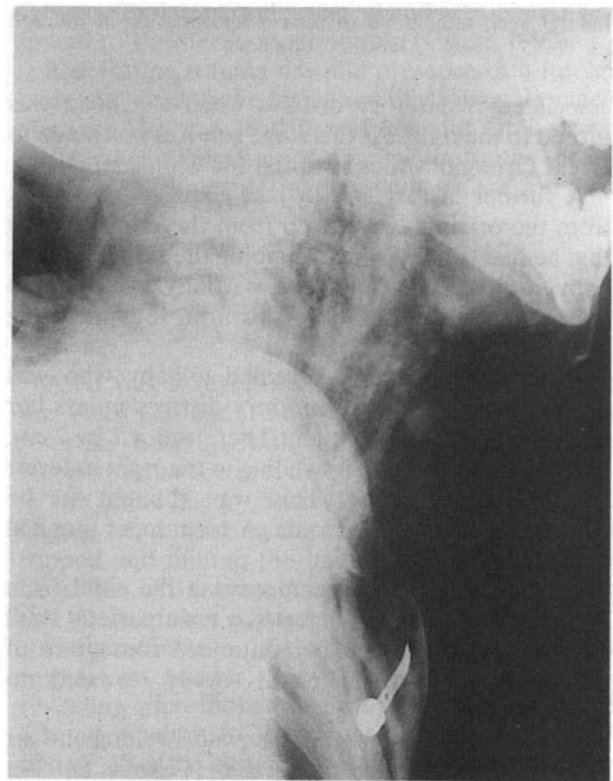


FIG. 6

Lateral neck radiograph of *Case 2*: with surgical emphysema of the neck and upper thorax.

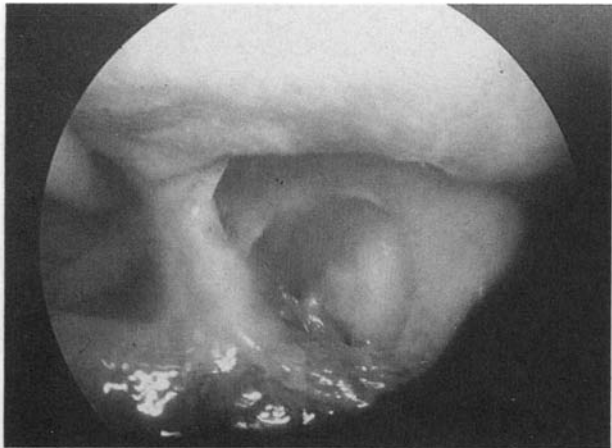


FIG. 7

View at pharyngoscopy of *Case 2*: laceration of the pyriform fossa containing food debris.

artery and internal jugular vein, down to the mediastinum. Swabs were taken for culture, wound toilet was performed and drains were inserted.

Post-operative recovery was protracted, complicated by septicaemia and acidosis. The child became apyrexial by the eighth post-operative day and the

neck wound ceased discharging after one month, and the child was allowed home. Outpatient review at three months revealed a well-healed neck wound.

Case 3

A two-month-old girl presented with difficulty in breathing and bleeding from the mouth. The father gave a history of feeding the baby and wiping her face with a tissue placed on the end of his finger. He subsequently fell asleep with the baby on his lap and awoke to the sound of her gurgling and seeing no tissue on the end of his finger he assumed that the baby had swallowed it. Attempted manual removal was unsuccessful and caused a minor degree of bleeding and so he attended the local Accident and Emergency Department.

On examination, there was reduced air entry bilaterally and blood oxygen saturation of 90 per cent despite 0.5l per minute nasal oxygen. A chest radiograph confirmed perihilar and right upper zone consolidation. Transfer was then arranged to Great Ormond Street Hospital.

Soon after arrival a pharyngolaryngoscopy was performed which demonstrated a right tonsillar laceration extending from the inferior tonsillar pole

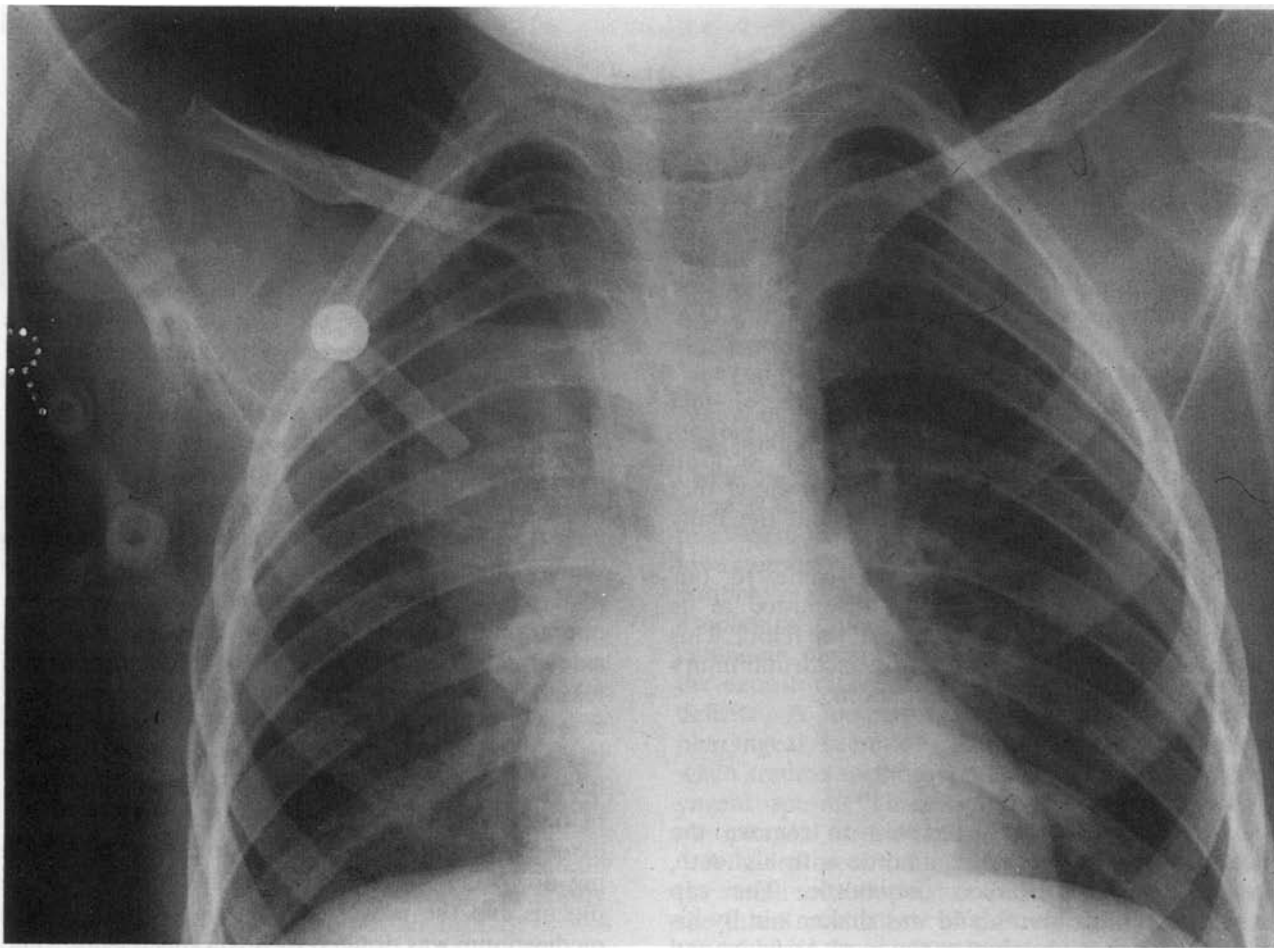


FIG. 8

Mediastinal abscess prior to neck drainage.

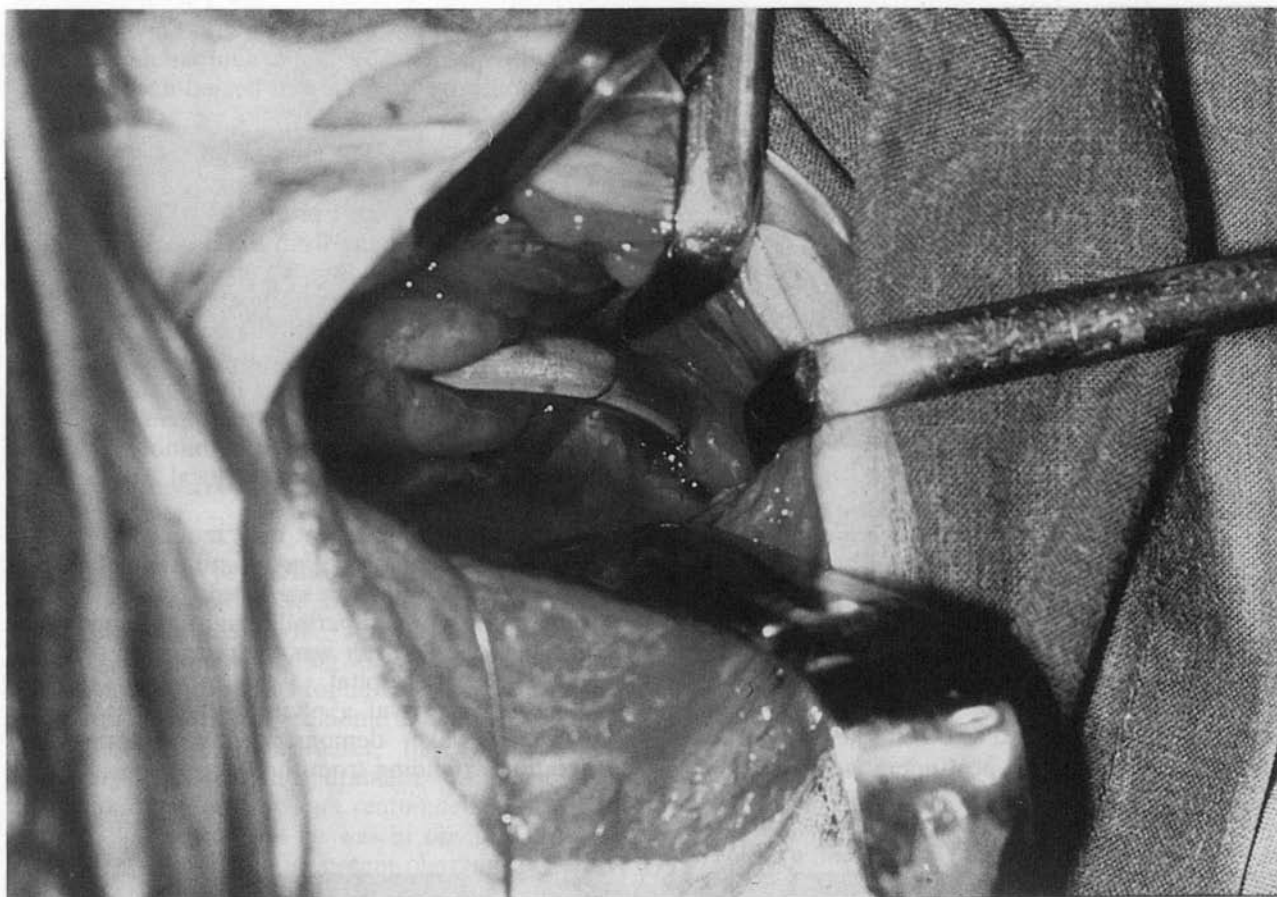


FIG. 9

Incision into neck through pharyngeal tear showing cricopharyngeus surrounding a nasogastric tube.

to the pyriform fossa with subglottic oedema. Mucopus was aspirated from the left main bronchus.

Post-operatively she recovered well, after a short stay in the neonatal intensive care unit with a regime of nasogastric feeds and intravenous antibiotics. One week after the original pharyngolaryngoscopy, a barium swallow confirmed a fully healed pharynx.

In view of the unusual history behind the original trauma, an interview was arranged with the parents and the social workers together with the surgical team. After lengthy discussion it was decided that non-accidental injury was not likely and the baby was discharged home.

Subsequent to this episode, it came to our attention that the child had been admitted to its local hospital with a spiral fracture of the femur. This again raised the question of a non-accidental injury and investigations were recommenced.

Case 4

A six-year-old child attempted to remove the metal cap from a ginger beer bottle with his teeth, having previously shaken the bottle. The cap exploded into his mouth and was shaken out by his parents who then took him to the local Accident and Emergency Department. On examination he had subcutaneous emphysema and obvious trauma to the

posterior pharyngeal wall and a chest radiograph showed mediastinal air. The child was taken urgently to theatre for pharyngeal repair and tonsillectomy. The post-operative course was complicated by the development of a right superior mediastinal abscess (Figure 8) which was managed with antibiotics and total parenteral nutrition. He was transferred to Great Ormond Street Hospital for drainage.

A pharyngo-oesophagoscopy, exploration of the neck and jejunostomy formation were performed. At operation, an extensive tear of the posterior pharyngeal wall was found from the level of the uvula to the cricopharyngeus. The right side of the posterior pharyngeal wall remained sutured from the previous operation but there was extensive slough on the left side culminating in a wide tear of the left pyriform fossa. There was no evidence of oesophageal injury so a naso-gastric tube was sited. The neck was then explored via an oblique incision along the anterior border of the sternomastoid muscle. The lower end of the pharyngeal tear was identified and noted to extend into an extensive slough lined cavity extending down into the mediastinum between the oesophagus and the prevertebral fascia (Figure 9). The mediastinum was drained by a 16 French gauge tube brought out through the neck incision. A 16 gauge pharyngeal tube was drawn out through the neck

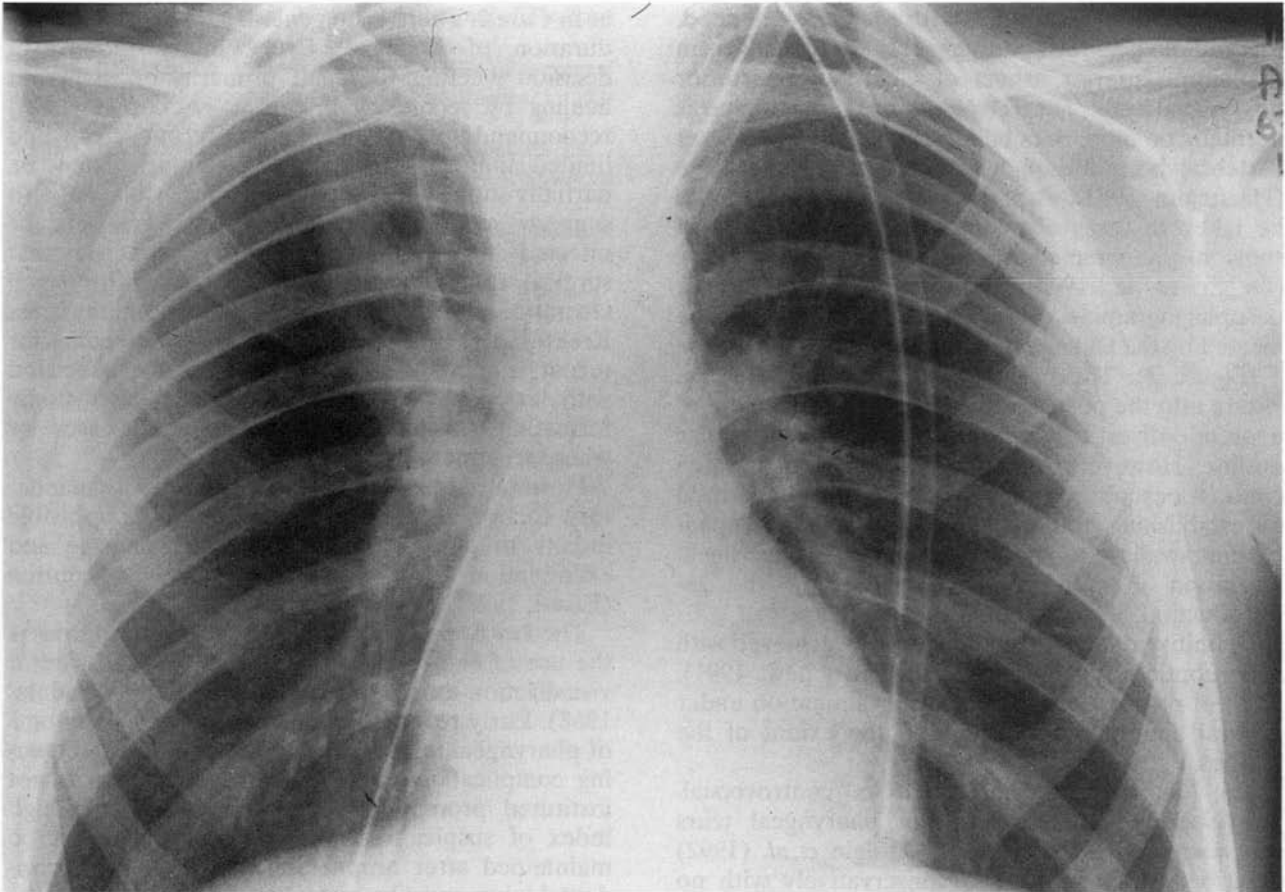


FIG. 10

Post-operative chest radiograph following neck drainage with drains *in situ*.

incision via the nose (Figure 10). A feeding jejunostomy was then formed.

The post-operative course was complicated by a prolonged pyrexia and difficulties with the jejunostomy. The patient was returned to theatre for a laparotomy at which an intussusception was identified and reduced. The child continued to make slow progress and the drains were removed uneventfully. A pharyngo-oesophagram showed no evidence of aspiration so oral feeding was slowly introduced. He subsequently tolerated a normal diet and gained weight.

Discussion

We have presented four cases of pharyngeal trauma of differing aetiologies. In a search of the literature we have found only one previous case (Dolgin *et al.*, 1992) of non-accidental injury, in which an 18-month-old baby presented with haematemesis. In our series, *Case 1* was almost immediately thought to be a non-accidental injury, since the history gleaned from the father changed repeatedly and so the social services were involved promptly. The mechanism of injury reported in *Case 2* was thought consistent with the injury sustained. *Case 3*, although initially thought to be an accident, was later regarded as being highly suspicious because of the

later presentation of the same child with a spiral femoral fracture. *Case 4* was, from the history, and the mechanism of injury, a genuine accident. This illustrates the difficulty in assessment of unusual injuries and suggests that a careful social follow-up should be undertaken.

Each of our cases exhibited much of the classical symptomatology associated with injury to the pharynx, oesophagus or airway in a child, namely pain in the neck with dysphagia and subcutaneous emphysema (Olu Ibekwe, 1991). Higher injuries tend to produce more cervical pain, chest pain characterizing lower oesophageal injury (Dolgin *et al.*, 1992). The patient may also present with dysphagia and dysphonia. On examination findings include: subcutaneous emphysema, signs of respiratory distress, the expectoration of bloody saliva and neurological deficits. A neonate may present with copious pharyngeal secretions and cyanosis. This occurs when trauma to the hypopharynx causes cricopharyngeal spasm. These symptoms mimic those of oesophageal atresia (Meyers, 1978).

A lateral neck radiograph has been shown to be the single most important diagnostic investigation in the initial evaluation of the retropharyngeal space (Sethi and Chew, 1991). It should be taken to exclude an abscess and to look for air in the soft tissues, as demonstrated in *Case 1* (Figure 1). It must

be taken during inspiration with the neck extended. The radiological retropharyngeal space extends from the antero-inferior aspect of C2 to the posterior pharyngeal wall. The retropharyngeal soft tissue is normally no more than half the width of the adjacent vertebral body although this is dependent on age (Hartmann, 1992). A plain chest radiograph should be taken in cases of pharyngeal trauma as it may show a pneumomediastinum or a pneumothorax (Dolgin *et al.*, 1992), illustrated by *Case 2*. An oesophagogram usually allows the injury to be located by the leakage of contrast material as in *Case 1* (Figure 2). The barium may immediately extravasate into the posterior mediastinum in the form of a 'pseudo-diverticulum' characterized by its irregular outline. However Hagan (1983) reported that the contrast oesophagogram was not a reliable method of establishing the diagnosis. We used a repeat barium swallow to show healing of the pharyngeal laceration in *Cases 3* and *4* prior to the re-introduction of oral feeding.

Definitive diagnosis of a tear may be achieved with a fiberoptic laryngoscope (Sethi and Chew, 1991). Each of our cases underwent an examination under general anaesthesia to ascertain the extent of the injuries.

The choice of management is controversial. Traditionally, the treatment of pharyngeal tears was always surgical. However, Dolgin *et al.* (1992) described 10 cases treated conservatively with no complications. Medical management relies heavily on early diagnosis, the institution of broad spectrum antibiotics and resting the oropharynx with nasogastric or gastrostomy feeding. It is of note that a nasogastric tube can predispose to reflux and prevent healing. An infection of the retropharyngeal space may resolve without surgery if antibiotic therapy is instituted early enough. Coulthard and Isaacs (1991) recommend a penicillinase-resistant penicillin combined with a third-generation cephalosporin or clindamycin and an aminoglycoside with metronidazole. It has been recommended by O'Neill *et al.* (1984) that transmural hypopharyngeal perforations in the neonate should be treated conservatively, except in cases of pneumomediastinum or pneumopericardium causing tamponade. The airway must be monitored vigilantly throughout and the child observed for signs of abscess development. These include: swelling in the neck, pyrexia, muffled voice and hyperextension of the head and neck, progressive dysphagia and odynophagia with dyspnoea which may progress to stridor and respiratory distress (Meyers, 1978). Older children tend not to present with stridor (Coulthard and Isaacs, 1991).

Surgical debridement and haemostasis under anaesthetic may be required in the first instance (*Case 4*) and any patient deteriorating on medical management should be surgically drained without delay as mediastinitis has a mortality of 50 per cent (Dolgin *et al.*, 1992). If the perforation is inaccessible, and extensive dissection would be necessary to ensure proper exposure, primary closure is not mandatory and simple drainage is all that is needed

as in *Case 2*. There is no general agreement as to the duration of drainage. Every injury requires a decision whether to repair primarily or to permit healing by secondary intention. Krekorian (1975) recommends primary repair for recent, clean and limited injuries. More extensive injuries may be partially sutured leaving a deliberate fistula. He also suggests secondary repair for dirty, extensive or infected wounds. Hagan (1983) proposed that surgical treatments should be reserved for small lacerations of <1 cm with minimal emphysema. Krekorian (1975) advocates nasogastric feeding for recent, limited, clean, lateral injuries not associated with extensive tissue damage; and gastrostomy formation for extensive contaminated cases or where treatment has been delayed.

Hospitalization and strict observation is mandatory for cases of blast trauma as it is impossible initially to predict the extent of the damage and examination under general anaesthetic is required (Efrati, 1992).

The key to prevention of such iatrogenic injuries is the use of soft-tipped suction catheters and careful visualization during intubation (Tucker and Padula, 1968). Early recognition of the signs and symptoms of pharyngeal injury are paramount as life-threatening complications may develop if treatment is not instituted promptly. We recommend that a high index of suspicion of pharyngeal injury must be maintained after oropharyngeal trauma. Non-accidental injury must be carefully considered in all cases of pharyngeal trauma in children, with involvement of the social support services at an early stage in any suspicious cases. Any child with oropharyngeal trauma must be admitted overnight for observation, and kept nil-by-mouth until the extent of the injury can be accurately established. It is important to note that a baby's oropharynx may be severely traumatized by a well-intentioned adult finger probing around in search of a foreign body.

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