Surgical Respiratory Emergencies in the Newborn

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SUMMARY

An approach to the neonate with respiratory difficulty is outlined. A systematic classification is presented and a plea made for certain routines in diagnosis and early management of the newborn.

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The normal newborn and the young infant are subject to a state of relative respiratory insufficiency and are highly susceptible to respiratory disorders. It is therefore not surprising that respiratory difficulty is the most common neonatal problem and accounts for half of all deaths of newborn infants.

In the early period of life, the lung volume is considerably less in proportion to the thoracic space than in later years. The mediastinum, heart and thymus are proportionately larger in the newborn. Furthermore, the trachea and main bronchi are comparatively short and wide in early childhood. This permits greater access of bacteria and irritants into the lower bronchial tree, and, together with the weak bronchial musculature, makes the tracheobronchial tree tremendously susceptible to inadequate clearing.

The rapid respiratory rate of newborn infants at rest (45/min) is the result of a relatively high metabolic rate requiring rapid respiration to maintain oxygenation, as well as a mechanical factor related basically to the efficient function of the diaphragm—the only means of ventilation at this age—which is to some extent restricted by the contents of the abdominal cavity. It is of interest to note that the tidal volume of air in infantile respiration is only 20 ml and there is very little breathing reserve.

Many causes of surgical respiratory distress can easily be corrected, but the eventual prognosis depends on early and accurate diagnosis and efficient treatment. In the discussion that follows a complete classification of surgical respiratory emergencies in the newborn is tabulated. This will, of necessity, include several non-surgical and non-respiratory problems, but, for the sake of completeness, these have been included because they may present and masquerade as surgical respiratory emergencies.

When approaching this problem, the doctor should note the warning signs during pregnancy and examine all newborns meticulously.

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WARNING SIGNS

Prematurity is often associated with congenital abnormalities and also with immature development of the pulmonary function and premature babies are therefore susceptible to respiratory distress. They are also often acidotic, either with or without hypothermia and hypoglycaemia. Premature babies are subject to patchy atelectasis due to inadequate clearing of the bronchi, and therefore also subject to pneumothorax which may develop insidiously as a result of obstruction and associated hyperinflation of the lungs.

Hydramnios may be associated with congenital abnormalities of the upper gastro-intestinal tract. If hydramnios is present one should be on the lookout for any abnormality of this kind the day the child is born.

Premature rupture of membranes, if associated with signs of infection in the mother, should arouse a suspicion of intra-uterine infection with pneumonia. The amount and timing of material analgesia or sedation is important in evaluating any problem with which the baby may be born. Any child who has a difficult delivery can present with problems after delivery, especially respiratory distress which may be of central origin.

EXAMINATION AT BIRTH

It is most important to establish a clear airway from the moment the child is delivered. If this is established and there is evidence of respiratory distress, as determined by the presence of a persistent tachypnoea, sternal or intercostal recession, central cyanosis or noisy respiration, one should immediately examine the baby carefully. The examination must be thorough, also checking the patency of both nasal openings and of the pharynx, particularly in relation to the tongue, which can easily cause obstruction. Cysts or tumours may also compress or displace the airway.

Having established that the child has a clear airway and is breathing freely, it is most important to examine the chest thoroughly for adequate air entry and also to determine whether there is 'dextrocardia' or mediastinal shift. Obviously, if all these points reveal no abnormality, a thorough systematic examination of the rest of the child is mandatory, whether respiratory distress is still present or not.

Before one can assure the parents that the child is normal in all respects, it is mandatory to pass a 10F nasogastric tube into the stomach before the baby is fed. It is old-fashioned and outdated to make a diagnosis of tracheo-oesophageal fistula when the baby presents with the complications of this congenital abnormality. The diagnosis of oesophageal atresia can be made if a 10F

nasogastric tube cannot be passed beyond 10 cm, and is confirmed by a postero-anterior and lateral chest X-ray film *without* the use of any contrast media. I make a plea that this form of examination be routine in the immediate postnatal period in all babies. If the tube is passed immediately before feeding there is little danger of any of the vasovagal problems which have been described.

Once a clear airway is established X-ray films of the chest must be taken to exclude pulmonary complications of underlying congenital abnormality. If endotracheal intubation is necessary to maintain oxygenation the location of the tube should be checked by X-ray film.

Children with respiratory distress often fill the stomach and upper gastro-intestinal tract with air as a result of the relative incompetence of the cardio-oesophageal junction and the large negative pressure created by the efforts of respiration. It is therefore vital to pass a nasogastric tube to deflate the stomach and alleviate the diaphragmatic embarrassment that may follow.

The approach to all newborns should therefore be: (*i*) establishment of an adequate airway with or without oxygen; (*ii*) the passage of a nasogastric tube to relieve gastric distension; (*iii*) radiological investigation, and (*iv*) maintenance of a suitable, stable environment as regards oxygen, temperature and blood glucose levels, until definitive treatment can be applied or the problem is alleviated. A careful, systematic approach to these problems will be rewarded by uncomplicated survival.

If the baby requires removal to a special centre it must be ensured that the child maintains adequate ventilation and an adequate blood sugar level, as well as normal environmental temperature during transfer. The posture of the baby greatly affects the ease of breathing, and it should be transported in the 'head up' position, with the head and neck extended. By so doing the upper airway is opened up and diaphragmatic excursion is least hampered and, most important, gastric reflux is avoided. This is especially so in oesophageal atresia with a tracheo-oesophageal fistula.

DIAGNOSIS AND TREATMENT

The cause of the respiratory problem may be immediately obvious and easily correctable, either surgically or medically. The majority of neonatal respiratory problems are medical in nature, fairly easily diagnosed but not so easily treated. Most of the surgical causes of respiratory difficulty are amenable to treatment with a good prognosis if diagnosed promptly. Diaphragmatic abnormalities, however, are easily missed and should always be considered, especially in unilateral pulmonary disease. Apparent

TABLE I. RESPIRATORY EMERGENCIES SEEN IN PAEDIATRIC SURGICAL CASES

Medical problems in surgical cases	**Pulmonary**	**Idiopathic respiratory distress** **Aspiration and infection** **Interstitial disease**
	Non-pulmonary	**Congenital heart disease (CHD)** **Metabolic disturbances or septicaemia** **Central respiratory depression—drugs** **haemorrhage** **infection**
Surgical respiratory emergencies	**Upper airway obstruction**	**Tumours, cysts and congenital deformities** **Choanal atresia** **Pierre-Robin syndrome** **Laryngomalacia**
	Mediastinal compression	**Tumours and cysts** **Vascular rings**
	Pulmonary compression	**Pneumothorax** **Fluid or blood in thoracic cavity** **Tumours** **Lobar emphysema** **Cystic lung disease**
Respiratory complications related to surgical conditions	**Pulmonary agenesis or dysgenesis** **Thoracic wall deformities** **Diaphragmatic abnormalities** **Oesophageal abnormalities** **Diaphragmatic compression with increased intra-abdominal pressure**	
	Pre- and postoperative problems	**Hypothermia** **Atelectasis** **Aspiration and pneumothorax** **Septicaemia and metabolic disturbances**

Some non-surgical, non-respiratory problems are included for completeness, since these may easily masquerade as respiratory problems.

'dextrocardia' should be regarded with suspicion and treated as a diaphragmatic hernia until proved otherwise. A systematic approach to the investigation is vital (Table I), and should always be associated with an adequate postero-anterior and lateral chest X-ray film. The interpretation of chest radiographs in the newborn may be difficult. Poor quality X-ray films are extremely misleading. Since there are many factors in the interpretation that may require expert knowledge, the attending doctor should not hesitate to seek expert advice after excluding gross radiological abnormalities.

Constant monitoring of the child's progress is vital and respiratory difficulty can be anticipated by regular blood gas and pH estimations.