Aspiration due to Difficulty in Swallowing

N. MATSANIOTIS, J. KARPOUZAS, M. TZORTZATOU-VALLIANOU,
and E. TSAGOURNIS

From the Paediatric Clinic of Athens University

Matsaniotis, N., Karpouzas, J., Tzortzatou-Vallianou, M., and Tsagournis, E. (1971). *Archives of Disease in Childhood*, 46, 788. **Aspiration due to difficulty in swallowing.** The swallowing mechanism after a propylidone ('dionosil') swallow was studied in 44 infants, aged 6 days to 6 months, who were admitted during a 6-month period to the Paediatric Clinic of Athens University because of choking spells during feedings or persistent vomiting.

Twenty-three infants showed aspiration of the opaque material into the tracheo-bronchial tree.

The incidence of aspiration was very high. It declined, however, with increasing age, indicating that it is a benign condition which might be related to neuromuscular immaturity in early life.

Mothers occasionally note that their infants have choking spells during feedings. This usually occurs only once or twice. In some cases, however, it is repeated several times and can even lead to aspiration pneumonia.

We have previously reported 5 cases of aspiration pneumonia in infants with difficulty in swallowing and have produced evidence that this may result from hypotonia of the pharyngeal musculature (Matsaniotis, Karpouzas, and Gregoriou, 1967). Suspecting that aspiration occurs in otherwise normal infants with choking spells during feeding or persistent vomiting, much more frequently than is generally believed, we decided to examine all such infants, aged 6 days to 6 months, admitted to our clinic.

Materials and Methods

During a 6-month period 393 full-term infants aged 6 days to 6 months were admitted to the Paediatric Clinic of Athens University. 44 infants had a history of choking spells during feedings or persistent vomiting. These infants were given a full physical examination and were studied radiologically after the administration of a radiopaque feeding.

Mothers were questioned about their girth during pregnancy, and the quantity of amniotic fluid.

In each infant the gag reflex, muscular tone, and tendon reflexes were assessed. Auscultation of the thorax during swallowing of the radiopaque material was also carried out.

An aqueous solution of propylidone 50% and benzyl alcohol 1.15% ('dionosil' aqueous) was used as radiopaque material. In 20 ml of this suspension 10 ml 0.9% of NaCl solution were added and the mixture was given to the infant by a standard feeding bottle. The mixture was easily accepted. The infants were examined in the left and the right lateral positions. The oesophageal reflux was also assessed in the Trendelenburg position.

Results

Although each bolus traversed the hypopharynx and entered the oesophagus without delay, a small amount remained in the laryngeal area until successive acts of deglutition cleared the larynx of the opaque material. This occurred in 21 of the 44 infants examined. In the remaining 23, 14 males and 9 females, the bolus divided at the larynx, the greater part entering the oesophagus, the remainder passing into the trachea. This finding was noted infrequently on the first swallow, and usually on the third or fourth swallow (Fig.).

Table I shows the age distribution of the exam-

TABLE I
Age Distribution of the Infants Examined

Age (wk)	1-4	4-8	8-16	16-24	Total
Infants examined	20	14	6	4	44
Infants with x-ray findings of aspiration	12	8	2	1	23

Received 24 May 1971.

FIG.—Diversion of opaque medium into tracheobronchial tree.

ined infants. Of the 23 infants who showed aspiration of the radiopaque material into the tracheobronchial tree, 12 had persistent vomiting, especially during the first week of life and 11 had at least one choking spell during feeding (Table II).

TABLE II

Distribution of Infants who had Persistent Vomiting or Choking Spells

	Persistent Vomiting	Choking Spells	Total
Infants examined	30	14	44
Infants with x-ray findings of aspiration	12 (40%)	11 (80%)	23

Rales in the chest were heard during feeding in 6 infants, all with choking spells; recurrent bronchopneumonia was also reported in 11 infants of the same group.

Generalized muscular hypotonia with weak

tendon reflexes was present in 4 infants with choking spells. The gag reflex was present in all 44 infants examined.

Radiological examination of the stomach in the supine and the Trendelenburg position was carried out in all infants; 14 had an obtuse cardio-oesophageal angle.

Two infants showed aspiration, one with persistent vomiting and the second with choking spells were re-examined 4 months later. No aspiration of the radiopaque material into the tracheobronchial tree was detected.

Before this study was undertaken aspiration of radiopaque material was noticed in 12 full-term infants, aged 6 days to 5 months. Of these, 9 had choking spells during feedings and 3 had persistent vomiting. 7 were male and 5 were female. Rales in the chest were heard during feeding in 3 infants, all with choking spells. Recurrent bronchopneumonia was also reported in 3 infants of the same group. Generalized muscular hypotonia with weak tendon reflexes was present in 2 infants with choking spells. The gag reflex was present in all 12 infants examined. Radiological examination of the stomach in the supine and the Trendelenburg position was carried out in 4 infants and an obtuse cardio-oesophageal angle was found in 3.

Discussion

The study of full-term infants after the 6th day of life with persistent vomiting or choking spells during feedings was intended to exclude cases of aspiration such as those described by DeCarlo, Tramer, and Startzman (1952). These authors studied the swallowing mechanism in 100 newborns, aged 12 to 24 hours, after a swallow containing lipiodol and found deviation of the radiopaque medium into the trachea in 13. With two exceptions this phenomenon was not present in newborns after the 2nd day of life. DeCarlo *et al.* (1952) noted that a barium swallow usually did not enter the trachea, whereas an oily contrast medium did. They postulated that the aspiration of lipiodol in these infants was probably due to neuromuscular immaturity and the low surface tension of lipiodol.

The incidence of aspiration in the infants of the present study was very high. The swallowing mechanism was not re-examined using barium for fear of aspiration pneumonia. The surface tension of water, barium, undiluted cow's milk, diluted cow's milk (50% with water), 'dionosil', and lipiodol was measured at the Department of Physical Chemistry at Athens University. The following values were found at 20.9 °C; water 74.5 dyn/cm², barium 62 dyn/cm², undiluted cow's milk 46.6

dyn/cm², diluted cow's milk 47·8 dyn/cm², 'dionosil' 41·8 dyn/cm², and lipiodol 40 dyn/cm².

The relatively higher surface tension of barium as compared to that of lipiodol, plus the neuromuscular immaturity, may explain why the 13 infants described by DeCarlo and his associates (1952) were able to swallow barium without aspiration. Because of its higher surface tension, barium does not disperse but descends to the stomach with the peristaltic movements of the oesophagus. It is therefore reasonable to study the swallowing mechanism using a radiopaque material dispersing similarly to milk, and dionosil seems to be a more appropriate material for such a study; it should be kept in mind, however, that the incidence of aspiration after a dionosil swallow may be higher than after a cow's milk swallow.

The incidence of aspiration in newborns and young infants gradually decreases with increasing age (Avery, 1964). This emphasizes the importance of neuromuscular immaturity as a cause of aspiration associated with difficulty in swallowing (Illingworth, 1969). This is corroborated by the presence of benign generalized muscular hypotonia in 4 infants and of an obtuse cardio-oesophageal angle in 14. On the other hand, infants with congenital hypotonia (Ford, 1960; Illingworth, 1969) may have difficulty in swallowing as part of the generalized hypotonia. Though pharyngeal muscle incoordination (Benson, 1962; Macaulay, 1951) cannot be excluded with certainty in these

cases, the presence of the gag reflex, the absence of neurological signs, and the long duration of symptoms all point to neuromuscular immaturity rather than to incoordination of the pharyngeal musculature.

This study indicates that difficulty in swallowing and aspiration occurring in infants with choking spells during feedings or persistent vomiting is a frequent and rather benign phenomenon which seems to be closely related to neuromuscular immaturity in early infancy.

REFERENCES

- Avery, M. E. (1964). Aspiration syndromes. In *The Lung and its Disorders in the Newborn Infant*, p. 143. Saunders, Philadelphia.
- Benson, P. F. (1962). Transient dysphagia due to muscular incoordination. *Proceedings of the Royal Society of Medicine*, **55**, 237.
- DeCarlo, J., Jr., Tramer, A., and Startzman, H. H., Jr. (1952). Iodized oil aspiration in the newborn. *American Journal of Diseases of Children*, **84**, 442.
- Ford, F. R. (1960). Congenital muscular weakness and hypotonia with mental retardation, defective developments of the testicles and obesity. In *Diseases of the Nervous System in Infancy, Childhood and Adolescence*, 4th ed., p. 36. Thomas, Springfield, Illinois.
- Illingworth, R. S. (1969). Sucking and swallowing difficulties in infancy: diagnostic problem of dysphagia. *Archives of Disease in Childhood*, **44**, 655.
- Macaulay, J. G. (1951). Neuromuscular incoordination of swallowing in the newborn. *Lancet*, **1**, 1208.
- Matsaniotis, N., Karpouzas, J., and Gregoriou, M. (1967). Difficulty in swallowing, with aspiration pneumonia in infancy. *Archives of Disease in Childhood*, **42**, 308.

Correspondence to Professor N. Matsaniotis, Paediatric Clinic of Athens University, St. Sophie's Children's Hospital, Athens, Greece.