Polypoidal organization of aspirated amniotic squamous debris (amnion nodosum) in middle-ear cavity of newborn infants

D. J. DE SA

From the Department of Pathology, McMaster University Medical Centre, Hamilton, Ontario, Canada

SUMMARY The development of polypoidal structures, derived from organization of amniotic squamous debris, in the middle-ear cavity of 3 infants is described. The lesions mimicked the development of amnion nodosum lesions of the placenta and were attached to either the tympanic membrane or the head of the stapes. They were accompanied by atypical metaplastic changes in the middle-ear epithelium. While the clinical significance of the structural changes is uncertain, they strengthen the case for histopathological examination of the middle ear in infant necropsies.

In one of the earliest discussions of otitis media in the newborn, Aschoff (1897) mentions 'neonatal otitis' by which he describes the reaction within the middle ear to aspirated amniotic squamous debris and likens the response to that seen in relation to a foreign body. It has been shown that squamous material aspirated into the middle ear *in utero* could persist for several days after birth and evoke a foreign body giant cell response, and in some instances could become secondarily infected (deSa, 1973).

The present paper describes the incorporation of persistent amniotic squamous debris into the wall of

the middle-ear cavity in 3 infants, resulting in clearly delineated polypoidal structures akin to the amnion nodosum or vernix granuloma seen on the placenta.

Patients

The clinical details of the 3 infants studied are shown in the Table. All 3 were extremely immature, of low birthweight, had low Apgar scores, and required ventilation for respiratory problems in the newborn period. The table also gives some of the main pathological findings outside the middle ear.

In this department it is routine practice to remove

Table Summary of main clinical and pathological findings

	Case 1	Case 2	Case 3
<i>Clinical findings</i>			
Gestation (w)	26	26	27
Birthweight (g)	850	890	1240
Apgar Score			
1 min	7	1	4
5 min	4	2	7
Age of infant (d)	8	46	24
<i>Pathological findings</i>			
Lungs	Bronchopulmonary dysplasia	Bronchopulmonary dysplasia	Bronchopulmonary dysplasia; healing abscess
Heart	Endocardial petechiae	Cardiac hypertrophy; myocardial necrosis and fibrosis	Cardiac hypertrophy; myocardial necrosis and fibrosis; platelet vegetation on endocardium
Brain	Organizing intraventricular haemorrhage	Periventricular leucomalacia (old with organization)	Subependymal cystic change with evidence of old haemorrhage
Aortic and arterial lesions (related to umbilical arterial catheterization (Tyson <i>et al.</i> , 1976))	Tunnel thrombus and plaque thrombi with emboli in liver pancreas, and adrenal, and embolic infarction of small bowel	Nodular lesions of aorta with calcified mesenteric embolus	Organizing thrombus of aorta; multiple infarcts of bowel with healing and peritonitis; splenic infarction

Received 21 April 1976

the right petrous temporal bone at necropsy in newborn and other infants. The intact right petrous temporal bone was fixed in 10% formaldehyde and subsequently decalcified. Blocks were then cut through the entire bone in a horizontal plane, using the external auditory meatus as the central point of reference (deSa, 1973). The blocks were washed, processed through to paraffin, and sections studied with both haematoxylin and eosin stains and Attwood's stain for amniotic squames (Attwood, 1958).

These 3 infants were part of a series of 85 infants whose middle ears were examined histologically. Of the 85, 62 showed evidence of bronchopulmonary dysplasia.

Pathological findings in middle ears

The earliest indication of incorporation in an infant of 8 days was the localizing of amniotic squamous debris into a loose mass, delicately attached to the tympanic membrane. In this process a surface layer of macrophages seemed to envelop and compact the loose amniotic debris into an ovoid structure open laterally (Fig. 1).

Fig. 1 Case 1. The tympanic membrane (T) and the attached amniotic squamous polyp are shown. The mass is delineated by a layer of macrophages that coalesce at one point to form a foreign-body type giant cell (G). (Attwood's stain. $\times 420$.)

In the second infant (46 days) a better developed, clearly demarcated, polyp was identified posterior to the head of the stapes. The nodule was completely covered by an epithelial layer, fibrous replacement of amniotic material could be seen within the nodule and there was a moderate chronic inflammatory infiltrate present (Fig. 2).

In the third infant (24 days) two well-organized nodules could be seen on either side of the head of the stapes and attached to it (Fig. 3).

Fig. 2 Case 2. Medial wall of the middle-ear cavity showing the upper area of the head of the stapes (H) and the (arrowed) sclerotic amniotic squamous polyp anterior to it. (Attwood's stain. $\times 45$.)

Fig. 3 Case 3. Medial wall of the middle-ear cavity, showing the two amniotic squamous polyps on either side of the stapedial head (H). The smaller nodule is situated anteriorly. (Haematoxylin and eosin. $\times 45$.)

The nodule posterior to the head of the stapes was also attached to the lateral wall of the middle-ear cavity by several fine adhesions. These adhesions were covered in part by epithelium and contained a central core of loose fibrous tissue and newly formed capillaries (Fig. 4). The nodule anterior to the head of the stapes appeared to be completely covered by epithelium, while the nodule situated posteriorly had a small deficiency in the epithelial covering and progressive incorporation of amniotic squamous material into the nodule could be identified. The appearances of the middle-ear lesions in these infants mimic the changes seen in amnion nodosum (vernix granuloma) of fetal membranes (Blanc, 1968).

Fig. 4 Case 3. Showing the site of attachment of the larger nodule to the wall of the middle ear cavity (arrowed). (H & E. $\times 640$).

Metaplastic changes in epithelium. In addition to the presence of the amniotic squamous nodules unusual metaplastic changes were identified within the epithelium of the middle ears. Islands of squamous metaplasia could be identified, often having an extremely complex histological appearance with scattered mucus-secreting cells in the mass of metaplastic epithelium. Small subepithelial droplets of hyaline material covered completely by epithelium were also identifiable on the lateral wall of the middle-ear cavity (Fig. 5), and in one infant (Case 3) a small nodule covered by epithelium was identified

(Fig. 6). This nodule bore a striking resemblance to the drusen-like lesions identified and reported in an earlier study of the middle ear in neonatal infants (deSa, 1973).

Discussion

It is not always appreciated, by pathologists and clinicians alike, that the pharyngotympanic tube is

Fig. 5 Case 3. Nodules of amorphous debris being incorporated into the wall of the middle ear (Attwood's stain. $\times 550$.)

Fig. 6 Case 3. One of many drusen-like nodules found in the middle ear. Note the thickened metaplastic epithelium, and the mononuclear cellular reaction in the stroma. The dark staining of the nodule is due to deposits of calcium. (Attwood's stain. $\times 880$.)

normally patent at birth and that the middle-ear cavity is therefore in direct communication with the nasopharynx. Despite numerous earlier studies, in particular a review by Bland (1972), the examination of the middle ear is not often included in routine assessment of the neonate. As a result it is not widely known that amniotic debris in the middle-ear cavity is a fairly common finding in many infants, irrespective of their gestational age. As clearly shown by the results of other workers (Aschoff, 1897; Bland, 1972) amniotic squamous debris may persist within the middle-ear cavity for several days, and may be responsible for some anomalous findings in the examination of the tympanic membrane, such as dulling of the tympanic light reflex (Bland, 1972).

The findings in the present study indicate a further step in the natural history of persistent amniotic squamous material within the middle-ear cavity. It is possible that the small drusen-like nodules (deSa, 1973; Fig. 6) represent the end result of sclerosis within the organized nodules of amniotic debris. It is likely also that aspirated amniotic squamous material within the middle ear may be a contributory factor in the development of the metaplastic epithelial changes described in this report.

All 3 of the infants in this report were subjected to high concentrations of oxygen for relatively long periods of time (Table), and perhaps this represents another important aetiological factor in the development of the metaplastic epithelial changes. It is obvious, however, that in situations such as those typified by the 3 infants in this series, it is difficult to separate the therapy given from the underlying indications for that therapy. The combination of amniotic squamous aspiration with varying degrees of organization of the amniotic material, and the high oxygen tensions to which the infants were exposed, may explain the development of the metaplastic epithelia.

The clinical significance of these changes are uncertain at present. In the absence of any detailed studies of acuity of hearing it is difficult, if not impossible, to state whether the lesions found at necropsy resulted in hearing loss during life. However, hearing loss cannot be excluded particularly since the squamous debris was attached to either the tympanic membrane or head of the stapes. In the 2 older infants in particular, progressive sclerosis could have led to some conductive defects, had they survived.

Despite a clear understanding of what the clinical significance of the amnion nodosum-like changes may be, the findings in the 3 infants in this series do strengthen the case for histological examination of the middle ear in neonatal and infant necropsies. Clearly the finding of amniotic squamous polyps, at

best a rare occurrence, offers definite and persistent evidence of intrapartum anoxia with aspiration of amniotic squamous material. In particular it would be interesting to know what the appearances of the middle-ear mucosa were in cases of sudden infant death syndrome (cot, crib death), since it has been suggested that many of these infants show evidence of chronic hypoxia (Naeye, 1973). If present, amnion nodosum-like lesions of the middle ear could provide useful documentation of intrapartum anoxia in these children.

The significance of the epithelial changes found in these infants is admittedly even more difficult to assess. In our department, in which extensive examinations of the middle ear are done, they are frequent histological findings at necropsy, and are not therefore due only to aspirated amniotic squamous material. Nevertheless, they do indicate at least some nonspecific injury to the middle ear mucosa. Clearly, if looked for and found in cases of sudden infant death, they might constitute a useful piece of evidence, especially since so little is known about the course of events in these children (Valdes-Dapena, 1975).

I am grateful to Dr. H. Lücke for help in the translations from the original German, and to Mrs. S. Putns for excellent technical assistance.

References

- Aschoff, L. (1897). Die Otitis media neonatorum. *Zeitschrift für Ohrenheilkunde und für die Krankheiten der Luftwege*, **31**, 295-346.
- Attwood, H. D. (1958). The histological diagnosis of amniotic-fluid embolism. *Journal of Pathology and Bacteriology*, **76**, 211-215.
- Blanc, W. A. (1968). Future of antepartum morphologic studies. *Diagnosis and Treatment of Fetal Disorders*, p. 15. Ed. by K. Adamsons. Springer, Berlin.
- Bland, R. D. (1972). Otitis media in the first six weeks of life: diagnosis, bacteriology and management. *Pediatrics*, **49**, 187-197.
- deSa, D. J. (1973). Infection and amniotic aspiration of middle ear in stillbirths and neonatal deaths. *Archives of Disease in Childhood*, **48**, 872-880.
- Naeye, R. L. (1973). Pulmonary arterial abnormalities in the sudden-infant-death syndrome. *New England Journal of Medicine*, **289**, 1167-1170.
- Tyson, J. E., deSa, D. J., and Moore, S. Thromboatheromatous complications of umbilical arterial catheterization in the newborn period: a clinicopathological study. *Archives of Disease in Childhood*, **51**, 744-754.
- Valdes-Dapena, M. A. (1975). Sudden death in infancy: a report for pathologists. *Perspectives in Pediatric Pathology*, Vol. 2, p. 1. Ed. by H. S. Rosenberg and R. P. Bolande. Year Book Medical Publishers, Chicago.

Correspondence to Dr. D. J. deSa, Department of Pathology, McMaster University Medical Centre, 1200 Main Street West, Hamilton, Ontario L8S 4J9, Canada.