

# Aspiration of ear plug into the respiratory tract

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Before the development of roentgenography, diagnosis of aspirated foreign bodies in air passages was suspected from the history and confirmed by physical examination. With improvement in the technical capabilities of roentgenography, clinicians began to rely more and more on the roentgenogram to make the diagnosis, especially in cases involving radiopaque foreign bodies.<sup>1</sup> Jackson<sup>2</sup> in the late 19th and early 20th centuries compiled an impressive collection of foreign bodies which he had extracted from the air passages and the upper esophagus.

The physical principles involved in the various degrees of obstruction of air passages, and the subsequent correlative physical findings are described by Nelson.<sup>3</sup> Caffey<sup>4</sup> gives a detailed explanation of the physical principles involved in the roentgenographic changes.

The present case demonstrates two points. First, the physician should be alert to the possibility of a foreign body when there is a history suggestive of aspiration, or when intermittent unilateral wheezing develops in a previously well child, even if a routine chest roentgenogram has been reported as normal. Second, it emphasizes the importance of inspiratory and expiratory roentgenograms in ruling out a foreign body in the tracheobronchial tract.

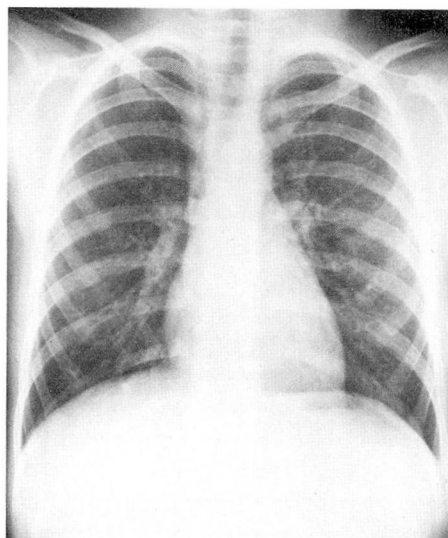
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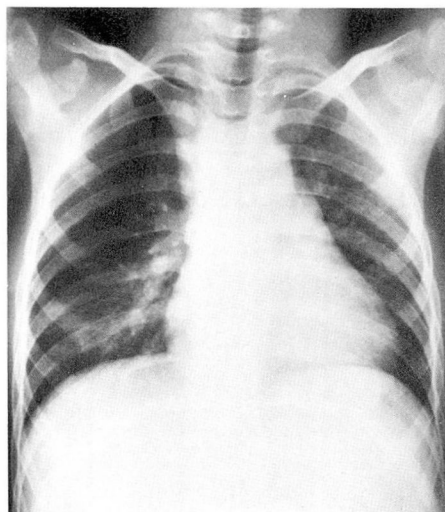
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## Case report

A 7-year-old girl was playing with a transistor radio with a loose ear plug when she began coughing, and was unable to locate the ear plug. The patient was taken at that time to a local hospital where a roentgenogram was interpreted as normal with no evidence of radiopaque foreign body. The patient had intermittent wheezing after that but never complained of dyspnea and had only an occasional non-productive cough without clinical evidence of pneumonitis. The patient's parents brought the girl to a pediatrician who ordered appropriate inspiratory and expiratory roentgenograms to rule out the presence of a foreign body (*Figs. 1 and 2*). The girl underwent bronchoscopy on the following day, and a plastic ear plug approximately 1.5 cm in length with a patent center was removed from the main stem of the right bronchus. There was only minimal mucosal reaction in the adjacent bronchus, and there was no evidence of



**Fig. 1.** Routine PA inspiratory roentgenogram shows only a slight decrease in vascularity in the upper lobe of the right lung, and a radiopaque density in the right hilum which overlies the right seventh rib posteriorly.



**Fig. 2.** An overpenetrated expiratory film demonstrates the accentuated vascularity in all areas except the upper lobe of the right lung which is overexpanded. The minor fissure is depressed. The foreign body now overlies the sixth rib on the right posteriorly.

atelectasis. The postoperative period was uneventful and the patient was discharged.

## Discussion

There are essentially three types of obstruction which occur when foreign bodies are aspirated into the tracheo-bronchial tract: (1) bypass valve, (2) check valve, and (3) stop valve.

In the first type, there is only minimal interference with the passage of air past the point of obstruction and, therefore, there are minimal changes noted clinically and on the roentgenogram. The foreign body does not interfere with the movement of air on inspiration or expiration and, therefore, its presence alone does not cause any significant clinical or roentgenographic features. If a severe inflammatory reaction is provoked, then findings consistent with a bronchitis or pneumonitis will be present.

In the check valve type, because the bronchi dilate on inspiration and contract on expiration, obstructive emphysema results. The prominent roentgenographic aspects include lucency on the affected side, with fixation, lowering, and flattening of the diaphragm on that side; there is shift of the heart and mediastinum away from the obstructed lung. Inspiration and expiration roentgenograms of the chest dramatize these changes more vividly.

The third type, the stop valve, is manifested by complete interruption of the ingress and egress of air past the point of obstruction and subsequently obstructive atelectasis results. The heart and mediastinum tend to be attracted to the obstructed side, and the diaphragm on the obstructed side usually is high. A less dramatic sign is the narrowing of the intercostal spaces on that side. It is also possible that there may not be any of the above changes except for the atelectasis, because the remainder of the lung has hyperexpanded to compensate for and occupy that area where the atelectatic lung had been.

This case is unusual because of the nature of the aspirated foreign body as well as its location. Upon reviewing the original film taken immediately after the aspiration, one can readily

understand how the film might have been interpreted as normal. The foreign body, because its center was hollow, did allow air to pass between the lung and the trachea and, therefore, was of the bypass valve type (*Fig. 1*). It was so situated that it actually occluded the bronchus of the upper lobe of the right lung only on expiration (*Fig. 2*). This was evidenced by the increased vascular pattern in all but the upper lobe of the right lung on the expiratory film.

### Summary

A case of bypass valve type bronchial foreign body is reported. The three types of bronchial obstructions are discussed. The importance of obtaining inspiratory and expiratory chest roentgenograms to diagnose check valve obstructive processes is emphasized.

### References

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