J Forensic Sci, January 2009, Vol. 54, No. 1
doi: 10.1111/j.1556-4029.2008.00912.x
Available online at: www.blackwell-synergy.com

CASE REPORT

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Megaesophagus and Possible Mechanisms of Sudden Death

ABSTRACT: Achalasia is a neurodegenerative condition characterized by esophageal dysmotility and megaesophagus. Two cases are reported that demonstrate unexpected deaths associated with previously unsuspected achalasia. Case 1: A 66-year-old woman was found dead at her home. At autopsy significant stenosing coronary artery atherosclerosis was found with cardiac failure. In addition, a striking finding was narrowing of the distal esophagus with marked proximal dilatation. The esophagus was completely filled with a large amount of soft masticated food and was bulging anteriorly, compressing the left atrium. Death was attributed to ischemic heart disease complicated by previously unsuspected achalasia. Case 2: An 84-year-old man collapsed and suffered a respiratory arrest while eating. Internal examination revealed narrowing of the cardioesophageal junction with marked proximal dilatation of the esophagus that contained approximately 50 mL of soft semi-fluid masticated yellow food paste. Fragments of yellow masticated food remnants were present in upper and lower airways but not within the stomach. There was a history of dementia with symmetrical cerebral ventricular dilatation found at autopsy. Death was attributed to food asphyxia complicating previously unsuspected achalasia with dementia. Megaesophagus may, therefore, be a significant finding at autopsy that may either be a primary cause of unexpected death or else may exacerbate or compound the effects of pre-existing underlying disease.

KEYWORDS: forensic science, megaesophagus, achalasia, sudden death, aspiration, arrhythmia, mechanisms

Causes of sudden death associated with primary esophageal disease are rarely encountered in forensic practice; i.e., the most common conditions involving the esophagus that result in unexpected and/or sudden death are usually secondary to disease elsewhere. Examples include foreign body impaction or aspiration due to neurological conditions that may impair the cognitive assessment of food and interfere with swallowing reflexes, and bleeding varices due to portal hypertension (1,2). Rarer primary conditions include black esophagus and perforation of Barrett esophagus (3,4). Ulceration with hematemesis may also occur with underlying infections such as Herpes virus (5). While these conditions have been recently reviewed, minimal information was available on lethal aspects of megaesophagus (1). The following cases provide an opportunity to redress this deficiency in the literature and to illustrate the specific pathological features of this condition and evaluate possible lethal mechanisms.

Case Reports

Case 1

A 66-year-old woman was found dead at her home. There was no evidence of trauma, and her only past medical history was of congestive cardiac failure. At autopsy the body was that of a thin elderly woman (height 150 cm, weight 36.6 kg, and body mass index [BMI] 16.3) with no injuries. Pitting edema of the ankles was present. There was no vomit staining of the face. Internal examination revealed marked atherosclerosis of the left anterior descending coronary artery producing >80% stenosis with lung congestion and edema. There was also evidence of emphysema, but no significant aspiration of gastric or esophageal contents. In addition, a striking finding was narrowing of the cardioesophageal junction (circumference 15 mm) with marked proximal dilatation (circumference 125 mm). The esophagus was completely filled with a large amount of soft semi-fluid masticated food and was bulging anteriorly compressing the left atrium (Figs. 1 and 2). Histologic examination confirmed the absence of ganglion cells in the myenteric plexus associated with focal areas of chronic inflammation and expansion of the intermyenteric zone by loose fibroconnective tissue (Fig. 3). There was no eosinophil infiltrate. There was artefactual loss of mucosa with chronic inflammation in the tissues immediately underneath the denuded surface. Multiple sections of the heart were examined including the left and right ventricles, interventricular septum, and cardiac conduction system using hematoxylin and eosin and van Gieson stains. All sections were unremarkable. Death was attributed to ischemic heart disease complicated by previously unsuspected achalasia.

Case 2

An 84-year-old man attended hospital with a history of nausea and vomiting. He was found to be mildly dehydrated and was orally rehydrated successfully. He collapsed and suffered a respiratory arrest while eating. His past medical history included hypertension and dementia. At autopsy the body was that of an elderly man (height 169 cm, weight 67 kg, and BMI 23.5) with no injuries. Internal examination revealed narrowing of the cardioesophageal junction with marked proximal dilatation of the esophagus which contained approximately 50 mL of soft semi-fluid masticated yellow food paste. Fragments of yellow masticated food remnants

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Received 16 Dec. 2007; and in revised form 5 June 2008; accepted 21 June 2008.

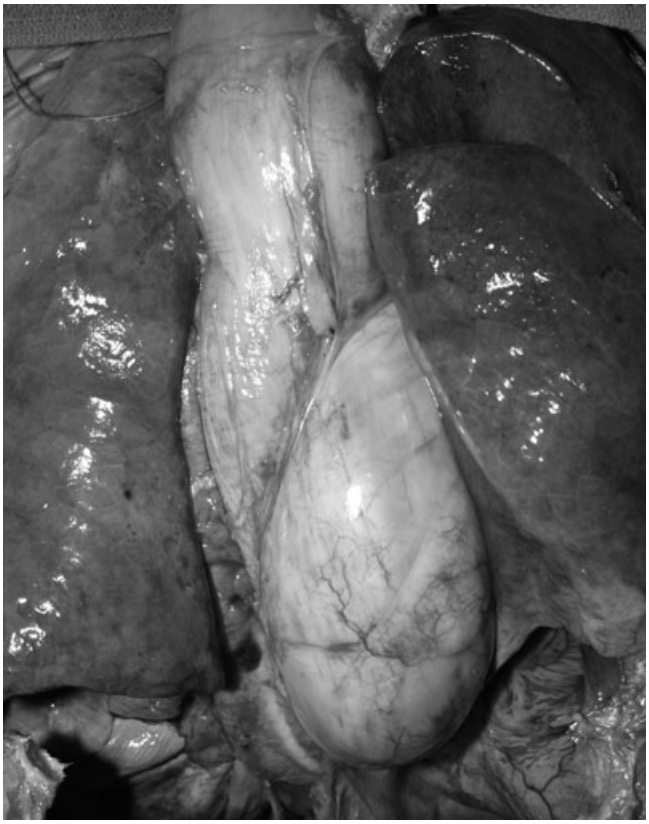

FIG. 1—*Posterior view of the lungs showing separation by a markedly enlarged esophagus in case 1.*

were present in the larynx, trachea, and main bronchi and within the distal airways associated with an early acute bronchopneumonia. There was no food paste within the stomach. Other significant findings included marked atherosclerosis of the left anterior descending and circumflex coronary arteries producing 80% stenoses, aortic atherosclerosis with previous aneurysm repair, hypertensive changes within the kidneys, and symmetrical ventricular dilation of the brain. Multiple sections of the heart were examined including the left and right ventricles, and interventricular septum using hematoxylin and eosin staining. All sections were unremarkable. Death was attributed to aspiration of food complicating previously unsuspected achalasia with dementia.

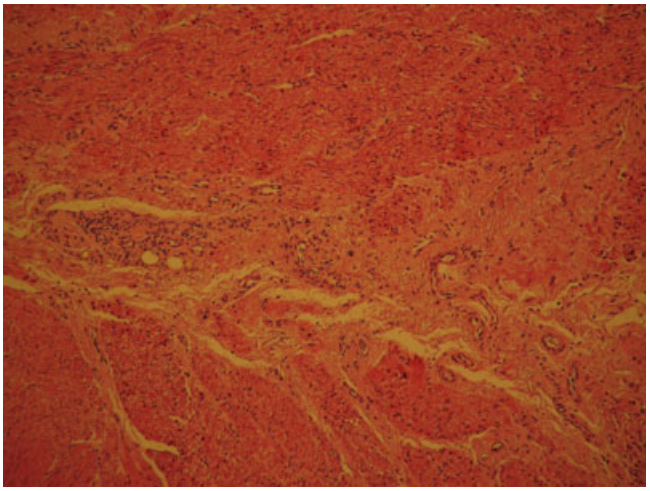

FIG. 3—*Histologic section of the esophagus in case 1 demonstrating loss of ganglion cells within the myenteric plexus with a chronic inflammatory infiltrate (hematoxylin & eosin, 100×).*

Discussion

Marked dilatation of the esophagus is characteristic of achalasia, a neurodegenerative condition where esophageal dysmotility is associated with failure of relaxation of the lower esophageal

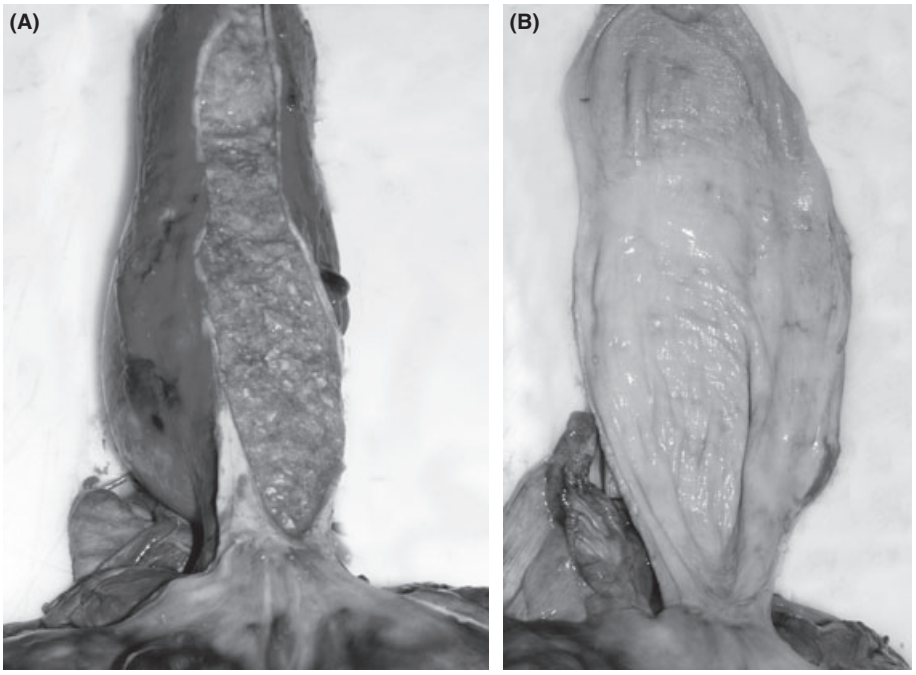

FIG. 2—*Opened esophagus demonstrating filling with masticated food paste (A). Once the contained food had been removed marked esophageal dilatation could be clearly seen with narrowing of the lower esophagus (B) (case 1).*

sphincter and esophageal aperistalsis. The word "achalasia" derives from the Greek meaning failure to relax (6). Achalasia may be primary or secondary, the latter due to such divergent conditions as protozoal infection with *Trypanosoma cruzi* (Chaga disease), malignant infiltration, paraneoplastic syndrome, previous surgery of the cardioesophageal junction, and amyloidosis (6). As none of these entities were identified at autopsy in either of the reported cases, it is most likely that the condition was primary. Achalasia forms part of the spectrum of primary esophageal motility disorders and is found in less than 10 individuals per 100,000 of the population. The incidence increases with age, peaking in the seventh decade, with a smaller peak in the third and fourth decades (6,7).

The etiology of primary achalasia is poorly understood and may involve abnormal functioning of extrinsic and intrinsic neural control, smooth muscle, neurotransmitters, and interstitial cells of Cahal resulting in failure of relaxation of the lower esophageal sphincter. Defective nitric oxide-mediated relaxation of the lower esophageal sphincter associated with cellular ion channel transport effects has also been hypothesized (6). While rare cases have been associated with heritable conditions, such as autosomal recessive Allgrove syndrome, familial grouping occurs in less than 1% of cases (6). Both primary and secondary immunological responses have been proposed, the latter possibly associated with previous viral infection (8).

The pathological features are quite variable with not all individuals having the same macroscopic or microscopic changes (9). Macroscopically, the most striking finding may be marked esophageal dilatation, as in the reported cases, with filling of the ballooned esophagus with food that has failed to pass the tight lower esophageal sphincter (Figs. 1 and 2). Microscopically, the features are also variable with no changes observed in some cases, contrasting with others where there is loss or absence of myenteric ganglion cells (Fig. 3) and interstitial cells of Cahal, with a lymphocytic infiltrate and collagen deposition (6). Ganglion cell loss has also been found in the stomach in 50% of cases (7). Involvement of vagal trunks and the dorsal vagal nucleus have been reported, as have myopathic changes of smooth muscle cells with an eosinophilic infiltrate (8,9). Immunohistochemical studies of early achalasia have shown the lymphocytes to be predominately cytotoxic T-cells, providing support for a possible immune mediated basis for the neuronal destruction (6). There may also be mucosal inflammation in longstanding cases (9).

The clinical manifestations of achalasia are also quite variable ranging from asymptomatic disease to sudden death. Affected individuals may have a history of chest pain, heartburn, hoarseness, coughing, and/or weight loss, rather than the classic complaint of dysphagia (7,10). Marked weight loss due to difficulty in swallowing and maintaining an adequate caloric intake may occur, as was demonstrated in case 1 where the BMI was only 16.3. Nausea and vomiting or regurgitation may occur as in case 2. A number of different mechanisms may be responsible for sudden death in individuals with achalasia. Death may simply result from aspiration of masticated food that has filled the esophagus and spilt over into the upper and lower airways, as in case 2. Airway compromise may also be due to tracheal compression, as may occur in cases of impacted intraesophageal foreign bodies (11). Cardiac arrhythmias may result from vagal or cardiovascular compression, or performance of a valsalva maneuver, and have been associated with QRS complex widening, high grade atrio-ventricular block, and ventricular asysytole (1,12). A valsalva maneuver consists of forced expiration against a closed glottis and may be utilized by individuals with achalasia to force food past the stenosed lower esophagus (13). Left atrial compression in achalasia has also caused outflow obstruction with hemodynamic compromise and congestive cardiac failure (14,15). Hematemesis from, and perforation of, esophageal ulcers have rarely been reported (16,17) and could theoretically be causes of sudden death. In case 1, it is likely that achalasia and pre-existing atherosclerotic coronary artery disease may have both predisposed to a lethal arrhythmia, with compression of the left atrium by the dilated esophagus exacerbating cardiac failure. In case 2, pre-existing dementia could have predisposed to aspiration of food; however, the risk of this occurring would have been increased by filling of the esophagus with food that was unable to pass in a timely fashion into the stomach. Possible mechanisms responsible for death in achalasia are listed in Table 1.

TABLE 1—*Possible mechanisms of death in case of megaesophagus.*

1. Aspiration of food
2. Tracheal compression
3. Cardiovascular compression
4. Vagal compression
5. Arrhythmias secondary to valsalva maneuver
6. Ulceration with hematemesis
7. Perforation
8. Exacerbation of pre-existing disease

In summary, the first indication of the presence of significant megaesophagus may be the rare complication of sudden and/or unexpected death due to a variety of possible mechanisms. These involve both structural and functional problems including aspiration of esophageal contents into the airways and cardiovascular and nerve compression resulting in significant arrhythmias. These effects may also compound pre-existing underlying diseases as in the reported cases. Pathological findings may vary among affected individuals, but are generally more pronounced with long-standing disease.

Acknowledgment

We would like to thank the South Australian State Coroner, Mr. Mark Johns, for permission to report selected details of case 2.

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