



## Case report

## Gastric rupture after bag-mask-ventilation

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## ABSTRACT

A 42 year old woman underwent bronchoscopy with procedural propofol sedation. During the procedure, the patient suffered respiratory arrest, and bag-mask ventilation was initiated. During forced mask ventilation, abdominal distention occurred. Even after correct placement of an endotracheal and a nasogastric tube, high inspiratory pressures persisted.

The abdominal CT scan revealed a high amount of intraperitoneal free air. An emergent laparotomy confirmed a stomach rupture. Immediately after opening of the peritoneal cavity, peak ventilatory pressures decreased.

In this case forceful bag-mask ventilation led to air insufflation into the stomach, increasing gastric pressure, and consecutive stomach rupture.

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## 1. Introduction

Mask ventilation is a common action during the introduction of a general anesthesia.

But even in emergency situations such as resuscitation or respiratory arrest this form of respiration is performed.

It should not be forgotten that this apparently easy activity can be dangerous and cause harm.

In this case report, we present one such complication.

## 2. Case report

A 42 year old woman was selected for rigid bronchoscopy with procedural propofol sedation in order to examine a suspicious pulmonary mass discovered during breast cancer staging. Shortly after beginning the procedure, the patient suffered respiratory arrest and the anesthesiologist resuscitation team was called.

Upon arrival of the resuscitation team, the patient was ventilated by mask bagging through pulmonologist personnel. It was immediately apparent that very high pressures were required for bag-mask ventilation as it was difficult to compress the bag.

Furthermore, the patient only exhibited solitary and insufficient breath excursions. The vital signs showed an oxygen saturation of 60%, a blood pressure of 90/60 mmHg, and a heart rate of 120 bpm.

The present anesthetist team inserted an oropharyngeal airway and continued to assist ventilation by mask bagging until a definite airway was established. Endotracheal intubation was quickly performed without difficulty and with visualization of the passage of the tube between the vocal cords. Following confirmation of correct tube placement by means of endexpiratory CO<sub>2</sub> measurements, the tube was fixed at a depth of 21 cm. Nonetheless, massive inspiratory peak and plateau pressures (50–60 mmHg) were required to raise the oxygen saturation above 90% as measured plethysmographically. Attempts were made to place a nasogastric suction tube both with and without the aid of the bronchoscope, but neither air nor gastric contents could be aspirated. As it was not possible to relieve the pressure of the by now massively distended abdomen and as the critical respiratory situation persisted, an abdominal CT scan was performed [Fig. 1].

The scan revealed a massive pneumoperitoneum measuring up to 10 cm ventrodorsally - most likely resulting from a stomach perforation and an emergent laparotomy was initiated. Immediately upon opening the peritoneal cavity, ventilatory pressures decreased to 20–30 cm H<sub>2</sub>O. Furthermore, a 7–8 cm long tear in the stomach musculature as well as a hole in the mucosa measuring a few millimeters was found, the perforation closed by suture repair, and the patient was placed in the surgical intensive care unit. The next day the patient was transferred to a general ward.

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Fig. 1. CT-scan, that shows a massive pneumoperitoneum.

### 3. Discussion

A study of medical literature showed that iatrogenic gastric perforations have been described in various contexts. They are serious complications. Case studies can be found in the context of cardiopulmonary resuscitation [1–3], mouth to mouth ventilation [4,5], esophageal intubation [6,7], and using nasopharyngeal catheters in unconscious patients [8,9]. Only three report of gastric rupture following mask ventilation could be found [10–12].

Case reports of and studies pertaining to iatrogenic gastric rupture were reported very early on.

Cassebaum et al. described a case, in which stomach rupture resulted following just 2 breaths applied in mouth to mouth ventilation. It could be shown that in mouth to mouth ventilation it is very easy for air to enter the stomach (beginning at pressure of 2.5 cm H<sub>2</sub>O) [13]. This clearly demonstrates how easily gastric insufflations can occur, especially mask bagging is difficult.

Safar et al. were able to demonstrate that protrusion of the mandible (jaw thrust maneuver) and the use of oropharyngeal devices can reduce gastric insufflations [14].

An additional complication of stomach rupture is the creation of a pneumoperitoneum.

Barnes et al. used an animal study to demonstrate that high intra abdominal pressure reduces venous flow from the extremities and splanchnic vessels, which leads to reduced cardiac output with reduced perfusion. Furthermore, this change in pressure can force the diaphragm further into the thorax, further increasing intra-thoracic pressure [15].

In the case report described above, it is likely that forceful mask bagging due to difficult ventilation led to air insufflation into the stomach, increasing gastric pressure, and culminating in stomach rupture. Following the rupture, air entered directly into the

abdomen thereby creating a pneumoperitoneum and leading to massive problems in lung ventilation. Fortunately, the patient's hemodynamics was not seriously compromised.

First line therapy of such a serious pneumoperitoneum severely compromising respiration/ventilation and potentially hemodynamic stability is confirmation of the suspected diagnosis followed by emergent laparotomy.

It demonstrates that even apparently easy actions as mask ventilation can potentially cause harm. Complications have to be recognized and treated immediately.

### Conflict of interest

None.

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