Intra-Abdominal Explosion due to Pneumoperitoneum Following Colon Perforation

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Introduction

Explosion in the abdominal cavity during surgery is a rare phenomenon. Surgeons may have previously experienced combustion in the surgical field caused by alcohol-based skin preparations, and electrocautery, however an explosion caused by free gas in the abdominal cavity is uncommon. Flammable gas is produced within the gastrointestinal tract. An explosion during open abdominal surgery, laparoscopic surgery, and colonoscopy is also possible [1]. Here, we report an abdominal explosion that occurred during a laparotomy in a patient with pneumoperitoneum, following a colonoscopy.

Case Report

A 51-year-old male was admitted to the Emergency Department at Pusan National University Hospital with abdominal pain. He had undergone a colonoscopy the previous day and had no specific medical history. On physical examination, overall tenderness and rebound tenderness on the abdomen were noted. Laboratory test results, including a complete blood count, liver function test, renal function test, and electrolytes, were within the normal range. The level of C-reactive protein (1.96 mg/dL) was slightly increased. Computed tomography (CT) and chest X-ray scans revealed pneumoperitoneum, which was considered to be an iatrogenic injury due to the colonoscopy (Figure 1). The patient underwent an emergency laparotomy. The skin was prepared using a 10% povidone-iodine solution, an incision was made using a scalpel, and the soft tissues and fascia were dissected by electrocautery. At the moment of incision into the peritoneum, there was a loud roaring sound, and a blue flame burst from the breach. The patient’s vital signs remained stable. After the laparotomy, superficial burns were observed in the serosa of the small intestine and left colon (Figure 2). There was no intraperitoneal soilage, or any injury other than left colon perforation. The perforation site on the left colon was primary repaired, and peritoneal irrigation was completed.

Discussion

Combustion requires fuel, oxygen, and a source of ignition.
Flammable gases can serve as the fuel in this reaction, and are produced throughout the gastrointestinal tract. The most common of these are hydrogen and methane, and their proportions vary with diet, digestion, and metabolism [1]. The explosive range of hydrogen is 4% to 72%, and for methane it is 5% to 15%, but neither is combustible under conditions of less than 5% oxygen. In the normal gastrointestinal tract, the oxygen concentration decreases from 10% in the stomach to 5% in the colon, but anesthesia using oxygen and nitrous oxide can increase the concentration of both gases in the bowel [2]. Although rare, a surgical explosion due to bowel gases is possible, and electrocautery is typically the source of ignition. An explosion during a colonoscopy due to argon plasma coagulation has been previously reported [3]. To prevent an explosion during a colonoscopy, it was proposed that a full bowel preparation was necessary to reduce flammable gases, and insufflation of carbon dioxide was needed at the time of the procedure. The study patient, as noted on a CT scan, did not seem to have enough bowel preparation, which probably made the bowel gas more flammable. Laser surgery can also cause an explosion, and in 1 reported case, burned the skin of the patient [4]. When opening a bowel using electrocautery, if there is a large amount of gas due to a bowel obstruction, an explosion may occur [5,6]. There are several reported cases of an explosion during a laparotomy which were due to intrabdominal gases, similar to the present case [7-9]. A patient was seriously harmed in 1 case [9], but in the other cases there were no complications. Fortunately, in the present case, there was no serious complication related to the explosion. The patient’s small intestine, left colon, and peritoneum were superficially burned, but recovered without any specific symptoms. Although explosions caused by gastrointestinal perforations are rarely reported, they have the potential to cause harm to patients. In cases where free gases are suspected in the abdominal cavity, it is recommended that a scalpel is used rather than electrocautery to remove the source of ignition.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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