

## A RARE PRESENTATION OF MASSIVE PNEUMOPERITONEUM FOLLOWING INGESTION OF LIQUID NITROGEN SNACK WITHOUT IDENTIFIABLE GASTROINTESTINAL PERFORATION

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### ABSTRACT

A 26 year old male patient presented with abdominal distension following ingestion of liquid nitrogen and was diagnosed to have massive pneumoperitoneum both clinically and radiologically. Patient underwent emergency laparotomy in search of perforation, the stomach, Intestines was examined and no hollow viscous perforation was found. All abdominal contents were normal, no tissue necrosis or haemorrhage, no free fluid or bleeding was found in the abdomen. Two abdominal drains were placed in the lesser sac and the pelvis and abdomen were closed. The patient was stable post operatively and tolerated oral feeds and discharged on 7th post operative day. Our study revealed that despite of having massive pneumoperitoneum, site of perforation cannot be identified

**KEYWORDS :** Liquid nitrogen gas, pneumoperitoneum, perforation

### INTRODUCTION

Liquid nitrogen ingestion is very uncommon. With the advent of Liquid Nitrogen cooled snacks, its consumption and adverse events following it are being reported. Liquid Nitrogen is obtained by compressing nitrogen gas at certain pressure and then cooling it. Due to its extreme low boiling temperature (-195.79°C), it rapidly gets evaporated at room temperature generating a white smoke.

Liquid nitrogen when ingested generates an enormous amount of gas and contributes to the rapid distension of any hollow viscus and ultimately causes unidentifiable perforations with a large volume of pneumoperitoneum. Here we share our experience of managing a case with massive pneumoperitoneum due to ingestion of Liquid Nitrogen.

### Case report:

We report our experience with a 26 years old male patient, who presented to the emergency department with abdominal pain and distension following ingestion of biscuits containing liquid nitrogen. He swallowed 8 biscuits containing liquid nitrogen at a time. Within five minutes he started to experience rapid abdominal distension with acute abdominal pain.

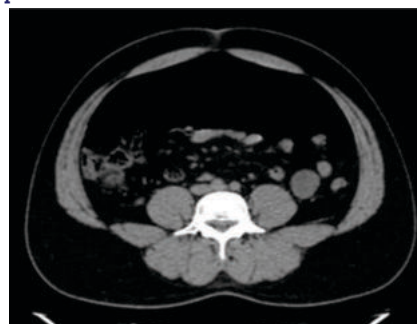
The patient was immediately brought to the hospital within 30 minutes. On examination his vitals were stable. Patient had mild respiratory distress and abdominal distension which is tense and tender and had no signs of peritonitis. Patient was taken for an Abdominal CT scan and found to have massive pneumoperitoneum with no obvious hollow viscous perforation. Routine investigations remained to be normal except for low haemoglobin (7.5gm/dl).

The patient was immediately taken to Emergency Exploratory Laparotomy. After incising the peritoneum a gush of air escaping was heard. The stomach, Intestines was examined including the lesser sac and posterior aspect of the stomach. After meticulous examination, no hollow viscous perforation was found. All abdominal contents were normal, no tissue necrosis or haemorrhage. No free fluid or bleeding was found in the abdomen. Two abdominal drains were placed in the lesser sac and the pelvis and abdomen were closed.

The patient was postoperatively kept in nil by mouth for 3 days, later liquids were allowed followed by soft diet. The patient made an uneventful recovery and was discharged on the 7<sup>th</sup> post-operative day.



**Figure 1: CT Abdomen in median plane showing pneumoperitoneum**



**Figure 2: CT of Abdomen in axial section showing pneumoperitoneum**

### DISCUSSION:

Cryogenic liquid of Nitrogen is colorless, odorless and very cold. It is noncombustible and nontoxic (1). Using cryogenic air separation methods, atmospheric air is compressed and cooled to produce Liquid Nitrogen (2).

Apart from industrial use, Liquid Nitrogen has many medical uses. It is most commonly used cryogenic agent for treatment of various skin lesions (3). It is also being used to treat and prevent recurrence of giant cell tumour of bone (4). For patients with rectal cancer, refractory bleeding can be controlled with endoscopic Liquid nitrogen cryotherapy (5).

Liquid nitrogen causes cell injury by various mechanisms. When a tissue comes in contact with LN, it cools the tissue to subzero temperature. This impact leads to tissue injury by two mechanisms. In first mechanism, by destroying blood vessels it causes tissue ischemia leading to necrosis. Secondly it causes formation of ice crystals in between the cells, inducing osmotic cell injury and cellular membrane disruption (6).

Injuries following accidental contact with LN are due to rapid cooling of the cells, resulting in thermal shock, formation of intracellular ice crystals, dehydration, toxic concentration of electrolytes and denaturation of lipoproteins. Vascular stasis leads to necrosis of the involved area (7).

Wherein Ingestion of LN is uncommon and the adverse effects following it are not well documented. However few cases of accidental ingestion of LN, leading to pneumoperitoneum are reported.

Because of the high volume ratio of 1: 694 (LN:gas), LN generate enormous gas at room temperature, producing smoke effect (8). This gas rapidly fills the hollow viscus and leads to abdominal distension, followed by perforation and pneumoperitoneum(8,9).

In majority of cases with history of LN ingestion, gastric perforation occurred in anterior wall of stomach near lesser curve (8,10,11 ). In few cases gastric perforation is seen in posterior wall of the stomach adjacent to lesser curve (9). Perforation either in the anterior or posterior wall of stomach explains the cause for formation of massive pneumoperitoneum.

However, in our case patient developed massive pneumoperitoneum following ingestion of LN, but no perforation was identified intra operatively. No haemorrhage, tissue necrosis or free fluid in the peritoneum was seen.

A similar case was reported by Mike J. Walsh et al, in which a 19 years old college student drank unknow quantity of LN, following which he developed Abdominal pain and distension. During laparotomy no site of perforation was identified (12).

When LN comes in contact with tissue, due to its low boiling point (-195. 79°C), large amount of nitrogen gas is formed, which rapidly distends the hollow viscus. This rapid volume expansion causes perforations in the stomach and causes massive pneumoperitoneum. In majority of cases perforation can be identified in the anterior wall of stomach adjacent to lesser curve. In few cases perforation are unidentifiable or spontaneously sealed. However the mechanism of diffusion of gas from stomach into peritoneal cavity has no evidence and it's yet to be established.

## CONCLUSIONS

After ingestion of liquid nitrogen, large amount of nitrogen gas is formed, which rapidly distends the hollow viscus resulting in pneumoperitoneum. Despite of having massive pneumoperitoneum, site of perforation cannot be identified. Mechanism of diffusion of gas from stomach into peritoneal cavity has yet to be proved by further studies

## Abbreviation

LN- Liquid Nitrogen

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