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The Use of Air as a Substitute for Ethiodized oil (Lipiodol) in Cyanoacrylate Injection: A Case Series

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SIGNIFICANCE

Cyanoacrylate injection is often used with lipiodol to allow injection of the former into gastric varices. However, lipiodol is expensive. This case series aims to show that air can be used to "push" cyanoacrylate, as a substitute for lipiodol. On literature search, there are no local or foreign papers on air being used as a substitute for lipiodol.

CASE SERIES

Two patients underwent Cyanoacrylate injection of gastric varices with air used as the medium to "push" the former into the gastric varices instead of ethiodized oil (Lipiodol).

The 1st patient, G.B. a 43 year-old male, known case of portal hypertension secondary to chronic liver disease secondary to chronic hepatitis B, referred to our institution due to hematemesis. On EGD, the following finding were noted: No esophageal varices. Esophagitis LA Grade A, Healing gastric ulcer. Isolated fundal varix (noted with a point of rupture, 1.1cc cyanoacrylate injected into the varix).

The 2nd patient, R.C. a 37 year-old male, Known case of Gastric varices secondary to non-cirrhotic portal hypertension secondary to infiltrating metastases from Colon Adenocarcinoma (T3N2b), S/P Laparotomy, bowel decompression, left hemicolectomy, protecting ileostomy, omentectomy, also admitted due to hematemesis. EGD findings showed: No esophageal varices. Esophagitis LA Grade B, Hiatal Hernia, Erosive Gastritis, Gastric Varices S/P Cyanoacrylate injection (tortuous vessels at the gastric fundus about 2cm below the CEJ. Biggest vessel with red color sign injected with 2cc pure cyanoacrylate).

In both patients, the injector was primed with canola oil, then filled with the 3 cyanoacrylate (1.5cc) until it reaches approximately 3cm before the injector tip. About 3cc to 5cc of air was used to "push" the pure cyanoacrylate into the gastric varices.

Both patients tolerated the procedure well with no complications and were discharged improved.

Follow up endoscopy was done on our 1st patient, G.B. and the following were seen: Esophagitis LA Grade A, Healing gastric ulcer, Isolated Gastric Varix S/P Cyanoacrylate injection (isolated fundal varix now noted to be stiff upon probing with closed biopsy forceps).

DISCUSSION

Varices occur in approximately 50% of cirrhotic patients. Gastric varices (GV) are less common

than esophageal varices (EV), with a prevalence of approximately 20% in patients with portal hypertension, and about 15%-25% of GV bleed during the patient's lifetime. Injection therapy with cyanoacrylates is now considered to be the first-line endoscopic intervention for bleeding GV and for the secondary prevention of gastric variceal bleeding.[1]

The tissue glue, N-butyl-2-cyanoacrylate, is a watery solution that polymerizes and hardens within 20 s in a physiological milieu and instantaneously on contact with blood. Because the rapid solidification of the glue makes endoscopic application technically difficult, it is necessary to dilute it with the oily contrast agent Lipiodol.[2]

In order to slow down polymerisation and to allow free injection into the varix, the Histoacryl is diluted by the addition of Lipiodol in a 0.5 ml/0.5 ml proportion.[3] Various ratios of glue and lipiodol are used, ranging from 1:1 to 1:1.6.1. Overdilution may increase the risk of embolization before the glue can solidify at the time of injection. Some cyanoacrylates (eg, Dermabond, Ethicon, Somerville, NJ; Glubran, Aspide Medical, La Talaudière, France) polymerize more slowly and thus do not require the use of lipiodol for injection. The exact approach to glue injection for gastric varices is not standardized. Expert opinion suggests that individual injections of glue are limited to volumes of 0.5 to 1.0 mL to minimize the risk of embolization, although data to support the optimal volume are lacking and may need to be tailored to the size of the varix.[4]

Kumar et al. reported that undiluted Histoacryl was effective in achieving initial hemostasis in case of actively bleeding gastric varices, and was very safe and not associated with embolic complications. But, in many institutions, Histoacryl is mixed with a contrast medium, radiopaque Lipiodol, (Guerbet Asia Pacific, Tsuen Wan, Hong Kong), to allow radiologic monitoring during and after injection.[5] Use of undiluted glue resulted in no cases of embolization in 170 patients.[4]

Tissue necrosis may occur due to paravariceal injection, which may lead to deep ulceration and occasional perforation. Paravariceal injection can also cause early rebleeding if the varix is not completely obliterated. Embolism is another rare but potentially serious complication. Emboli may go to the lung, but systemic (arterial) embolization has also occurred. An important cause of increased risk of embolism during procedure is instillation of more than 1 mL of the Histoacryl/Lipiodol mixture per injection. Portal and splenic vein thrombosis presenting with severe abdominal pain starting 30 min after glue injection has been reported. Other immediate complications include fever, impaction of the injected needle and early rebleeding at three to four days after injection due to necrosis around the site of injection.[2]

It should be noted that two of the risk factors for extravariceal embolization with Histoacryl treatment include a large injection volume, and dilution of radiolucent Histoacryl with radiopaque Lipiodol. Larger volumes of Histoacryl used for treating varices of higher blood volumes increase the chance

of leakage, and by prolonging polymerization, overdilution with Lipiodol can increase the risk of embolizaion.[6]

For air embolism to occur there needs to be a communication with the vasculature and a pressure gradient favouring the air passage. When the gastroscope is operating at its full capacity, air is infused at a rate of 30 mL per second. From the literature the volume of air needed to cause fatal air embolism ranges from 70 to 130 ml, if the velocity of insufflations is high.[7] Experimental studies have been conducted using several animal models to assess the volume of VAE necessary to provoke circulatory collapse. Lethal volumes of air entrained as an acute bolus have been concluded to be approximately 0.5– 0.75 ml/kg in rabbits5 and 7.5–15.0 ml/kg in dogs. Translating such data into the adult human would be difficult, if not for some parallel confirmation from the clinical literature. From case reports of accidental intravascular delivery of air, the adult lethal volume has been described as between 200 and 300 ml, or 3–5 ml/kg. The authors of these reports suggest that the closer the vein of entrainment is to the right heart, the smaller the required lethal volume is.[8]

An air embolism is an uncommon but potentially catastrophic event. Many cases are subclinical with no adverse outcome.[9]

CONCLUSION

Air can be used as a cheaper substitute for ethiodized oil as a medium to “push” cyanoacrylate. However, more studies may have to be performed before it can be universally recommended.

CONFLICTS OF INTEREST

The authors have no financial conflicts of interest.

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