

# Stress gastric ulcer after cardiac surgery: Pathogenesis risk factors and medical management

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## ABSTRACT

**Stress ulcer lesions of upper gastrointestinal tract are well recognized in patients undergoing open cardiac surgery. Gastrointestinal bleeding following cardiac surgery is infrequent with significant morbidity and mortality. The pathogenesis of mucosal lesions and subsequent haemorrhage is complex and multifactorial. The diagnosis as well as the treatment of this complication remains a challenge for surgeons. Identifying the source of bleeding can be difficult. Despite of the successful control of haemorrhage using various combinations of endoscopic and pharmacological therapies, the mortality rate remains unchanged. Benefit of routine stress ulcer prophylaxis remains controversial.**

**Keywords:** Stress Gastric Ulcer; Upper Gastrointestinal Bleeding; Cardiac Surgery

## 1. INTRODUCTION

Since Berkowitz [1], who first reported acute peptic ulcer after cardiac surgery in 1957, there have been several clinical studies concerning upper gastrointestinal haemorrhage as a complication of this entity in patients after cardiac surgery.

The majority of those reports were retrospective studies. Rey J.F. [2] performed prospectively during 2 years systematic gastroscopy in all patients after cardiac surgery and they observed bleeding lesions in 65 cases including 56 gastro-duodenal ulcerations [56/65 = 86%].

Although peptic ulcer disease (PUD) is common in adults, bleeding from an active ulcer after open cardiac surgery is infrequent but the morbidity and mortality, as well as the cost in terms of prolonged hospitalization, are all considerable [3-6].

The purpose of this review was to examine the pathogenesis and risk factors of active peptic ulcer disease

after cardiac surgery.

## 2. INCIDENCE—EPIDEMIOLOGY

Stress ulceration and upper gastrointestinal haemorrhage (UGH) among patients who have undergone cardiac surgery have been reported to occur with a frequency varying from 0.35% to 0.9% [7-10]. Aljarallah [11] has reported a frequency of 0.4% in post coronary artery bypass graft; he found that it was most frequently related to a duodenal ulcer. The incidence of stress lesions in children after cardiac surgery is similar to the one in high risk adult patients [12].

The last investigation in North America to address this subject took place in 1997 was conducted by perugini *et al.* with an incidence of 1.3% [13]. A few reports from Europe have recently come out with similar results.

The studies with the highest reported rates of post operative bleeding are those conducted since 1970s until 1980s, prior to the implementation of interventional endoscopic therapy.

Previous studies have reported that the acute peptic ulcer after cardiac surgery complicated by upper gastrointestinal bleeding was associated with a mortality rate ranging from 1% to 22% [7-9].

In a prospective study conducted by Mc Sweeney Mary E *et al.* [14], gastrointestinal bleeding was associated with the highest risk of in-hospital mortality, renal failure and stroke. Gastrointestinal perforation (GIP) is uncommon and the literature contains little information about it. Alebouyeh N [15] reported 15 cases of GIP after coronary artery bypass graft.

## 3. PATHOGENESIS AND PREDICTOR FACTORS

During and after surgery, patients are exposed to a number of factors that increase the risk of upper gastrointestinal complications, including gastrointestinal tract mu-

cosal irritants, antiplatelet and anticoagulant drugs and stress.

- Psychological stress:

Patients undergoing cardiac surgery are subject to considerable emotional stress. Although mortality rate was low, despite of improvement in management, many patients fear that they may not survive the operation. The added stress of modern intensive care units, with the almost constant stress provoking activity and the temporary dissociation from normal day and night sequences, serve to compound the emotional stress experienced by each patient.

- Physiological stress:

Though open heart surgery have been greatly simplified thank to various improvements in peri-operative care, monitoring, anaesthesia and operative techniques, we noted that gastrointestinal ulcerations leading to bleeding had not changed through the years. The pathogenesis of peptic ulcer disease and stress ulceration is complex and multifunctional. The mechanism by which cardiopulmonary bypass leads to pathophysiologic derangements and gastrointestinal ulceration have yet to be ascertained [16]

These include non pulsated flow, blood trauma, activation of humoral amplification cascade (complement, fibrinolysis, coagulation and bradykinin-kallikrein), anticoagulation, hypothermia...[17]

The major factor implicated in cardiac surgery is reduced systemic blood flow, which leads to inappropriate oxygen delivery and energy deficit. This ischemic situation contributes to gastric mucosal acidity and increased cellular permeability [18]. The gastrointestinal tract does not have the ability to autoregulate to compensate reductions in blood pressure. Increased mucosal permeability correlates with the degree of endotoxemia [17], which may lead to vasoconstriction and cellular function is impaired leading to mucosal damage [19].

These findings coincided with mucosal hypo perfusion and ischemia that increased the likelihood of colonization and infection [20].

There is still the controversy about the gastric acid. Cardiopulmonary bypass decreases PH which declines further after operation [21]. Prior to the advent of histamine blockers and regular use of antacids, duodenal and/or gastric erosion, ulcer and bleeding were frequent following cardiac surgery [22]. Munakatar *et al.* [23] did not find a relation between gastric acid secretion and stress ulceration. Some studies demonstrated suppression of acid secretion and benefit in patients given routine stress ulcer prophylaxis [24,25]. These results suggest that acute acid secretion may contribute to stress peptic ulcer.

Factors such as longer cardiopulmonary bypass, prolonged mechanical with high positive end expiratory pressure (PEEP) ventilation, blood transfusion, re-ex-

ploration for bleeding, postoperative arrhythmia and the use for intra aortic balloon pump (IABP) combine to produce mucosal injury and gastro duodenal ulceration [13,20].

Others factors such as advanced age, emergency operation, acute or chronic renal failure, pre-existing peripheral vascular disease are often correlated with gastro duodenal complications [26-29] A found that gastric or duodenal ulcer was the predominant cause in 60% in the cardiac surgery and 40% in vascular surgery. Long term use of steroid drugs are also relevant in patients after cardiac transplantation [30]. There are conflicting opinions about the role of pre-existing peptic ulcer disease as a cause of post operative gastric ulcer and hemorrhage [31,32].

Kalz [33] and Lebovics, [34], found that patients with a history of peptic ulcer disease were more at risk for upper gastroduodenal bleeding after cardiac surgery than patients without previous peptic ulcer disease, but the current reports did find according to Halm *et al.* [35], unlike in chronic ulcer, that *Helicobacter pylori* does not appear to be associated with stress ulceration in critically ill patients.

Current reports found no statistically significant difference in the total number of gastrointestinal complications between the off-pump and on-pump coronary surgery. Off pump coronary artery bypass does not seem to protect patients from these complications [36,37].

#### 4. CLINICAL FEATURE

Several reports agree that the poor outcome of gastrointestinal complications - gastric ulcer included- after open cardiac surgery is at least in part due to the frequently delayed diagnosis [38]. In seriously ill patients it is difficult to predict this complication. Those patients who required prolonged ventilation and sedation could not communicate symptoms, postoperative analgesia tends to mask symptoms and signs of abdominal pathology, in addition seriously ill patients could not be moved from an intensive care unit to perform certain radiological investigations or endoscopy.

Furthermore, brief episodes of unspecific gastrointestinal complaints such as poor appetite, lack of taste, or nausea, were reported with an incidence ranging from 20 to 40% of patients after cardiac surgery [39].

It is important to note some particularities of this complication. It occurred frequently in patients undergoing coronary bypass graft than patients undergoing valve surgery. Aspirin in patients undergoing coronary bypass surgery and anticoagulation therapy after valve replacement were the other etiological factors leading to gastric ulceration.

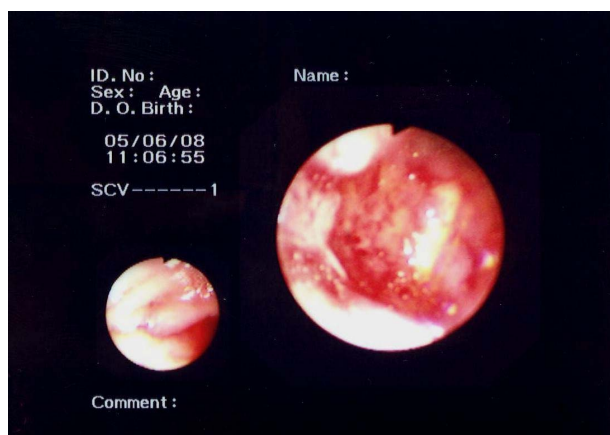
The onset of symptoms is not necessarily immediately

after surgery, but may develop after a delay of several days. The mean time point of onset of gastro duodenal ulceration was 9 - 13 days after the bypass surgery [9,27, 40].

Rey [2] noted two peaks of bleeding after surgery. The first on the 5<sup>th</sup> day, related often to multiple gastric and/or duodenal ulcer, the second on the 21<sup>st</sup> day related to large and deep duodenal ulcer, it is also important to note that 22% of bleeding was not exteriorised. Recurrent or uncontrolled bleeding was reported in 5.3% to 12.5%. Most patients stopped bleeding spontaneously (**Figure 1**). Therefore, it can be difficult to determine which source is the cause of the acute bleeding. Initial evaluation should include placement of a nasogastric tube and gastric lavage. Endoscopic examination could be important in a cardiac surgical department or surgical theatre. It is a useful tool to detect bleeding lesions (**Figure 2**).

## 5. TREATMENT

When the diagnosis of stress gastric ulcer was made, an intensive medical program in accordance with severity of



**Figure 1.** Endoscopic view of gastric ulcer after cardiac surgery.



**Figure 2.** Endoscopic examination of gastric ulcer.

bleeding was begun. A lumen nasogastric tube was used to serve as an important monitoring device to assess the degree of continuing haemorrhage. The medical therapy included intravenous proton pump inhibitors (PPI), red blood cells and fresh frozen plasma transfusion. Medical treatment is not always efficient in stress ulcer. Endoscopic therapy has generally been recommended as the first-line treatment for upper gastrointestinal haemorrhage as it has been shown to reduce recurrent bleeding, the need for surgery and mortality [41]. There has been some debate as to whether applying adrenaline-injection therapy before endoscopic clipping adds any benefit compared to clipping alone. Hemoclips, injection of adrenaline and thermocoagulation are the most commonly used types of endoscopic haemostasis for the control of gastrointestinal haemorrhage. These therapies seemed simple and harmless. In case of severe bleeding, when medical and endoscopic treatment failed, the patient was referred to a digestive surgeon, and interestingly the need for surgery was very low.

## 6. CONCLUSION

Gastro duodenal stress ulcer following cardiac surgery is associated with high morbidity and mortality rates. The diagnosis is often difficult. The clinician should suspect it in high risk patients and endoscopic examination must be performed.

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