



## **Mind the Drain: Inadvertent Colonic Puncture after Mediastinal Drain Insertion in a High-risk Cardiac Surgical Patient**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author KS wrote the detailed patient clinical record and the manuscript, conducted the review of literature, obtained consent from the patient's relative, designed the figures and offered intellectual input. Author CKL was involved with the provision of clinical material relevant to the case, critical appraisal and editing of the manuscript including submission and revision. Both authors read and approved the final manuscript.*

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**Case Study**

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### **ABSTRACT**

Cardiothoracic surgeries are known to cause gastrointestinal complications due to its proximity to the peritoneal cavity. Such complications in susceptible patients are associated with adverse post-operative outcomes. While the majority of cases reported in the literature were related to intrinsic GI complications as consequences of physiological disturbance, e.g. stress ulcers and mesenteric ischaemia, complications originating from extrinsic factors, e.g. instrumentation and drain insertion, are infrequently discussed and the potential risks can be equally great if not higher. Relevant to this, we present a case of colonic perforation secondary to a misplaced mediastinal drain in a patient who underwent a high risk redo surgery for mitral valve replacement.

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## 1. INTRODUCTION

Colonic perforation following thoracic surgery has been reported. Gastrointestinal (GI) complications post cardiac surgeries were summarised by Rodriguez et al. [1] in their comprehensive review. Amongst 151,562 patients from 35 studies between 1966 and 2001, it was found that the average rate of GI complications was about 1.21% and the resultant death rate was 32%. Inadvertent colonic perforation in high-risk cardiac surgery is not only theoretically plausible but possible and needs a high index of clinical suspicion to identify and treat the problem [1].

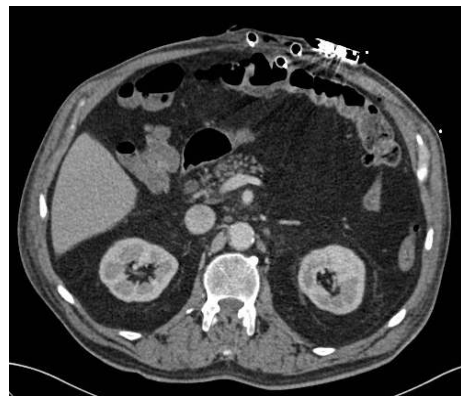
## 2. PRESENTATION OF CASE

An 80-year-old man was admitted to the intensive care unit (ICU) after having had a redo mitral valve replacement. He had previously undergone mitral valve repair 20 years ago. His past medical history included a Hartmann's procedure for small-bowel obstruction and diverticulitis. His post-operative course was uneventful and he was extubated within the first 24 hours; his haemodynamic profile was appropriate and was progressing well from a multi-organ system viewpoint. On day 3 post-surgery, it was noted that the patient was complaining of abdominal pain, and his chest X-ray (Fig. 1A) revealed a moderately raised hemi diaphragm with free gas underneath, which was attributed to routine post-surgical changes. A subsequent clinical examination was suggestive of peritonitis substantiated by a diffusely tender abdomen and inflamed abdominal wall at the site of the mediastinal drain with faeculent material draining through the tube. CT abdomen and pelvis revealed that the drain was dissecting through the transverse colon and a large posterior mediastinal haematoma, measuring 6x12 cm, compressing the left atrium was detected (Figs. 1B and 1C). As a result, the patient underwent urgent laparotomy for resection of a perforated transverse colon, and formation of a colostomy and mucous fistula. A history of previous cardiac and abdominal surgery had placed our patient at high risk for this inadvertent iatrogenic complication. As a consequence he had to undergo a series of bowel surgeries including a colostomy. While patients can die from such consequences, our patient fortunately made an uneventful recovery and had his stoma reversed 6 months after. He

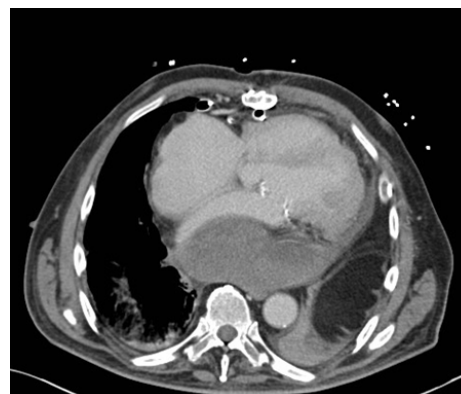
has since been living independently and free of symptoms in the community.



**Fig. 1A. Post-operative day 3 chest X-ray after redo mitral valve replacement**



**Fig. 1B. CT abdomen and pelvis: Presence of free air and transverse colonic perforation from mediastinal drains through abdominal wall**



**Fig. 1C. Large posterior mediastinal haematoma with compression on left atrium**

### 3. DISCUSSION

Complications post cardiac surgery with relevance to the GI system were almost always related to physiological insults, with variable incidence, ranging from upper and lower GI bleeding, mesenteric ischaemia, hepatobiliary inflammation, peptic ulcer disease and liver failure [1]. The proposed mechanisms were systemic hypo perfusion and micro emboli formation leading to visceral and mucosal ischaemia. The highest mortality was observed in those patients who developed liver failure (56%), bowel ischaemia (50%) and peptic ulcer (36%). However, evidence is sparse in relation to gastrointestinal complications, caused by instrumentation, which is part and parcel of cardiac surgery, with examples including sternotomy kits, sternal wires and mediastinal drains [1-4]. While the majority of cases reported in the literature were related to intrinsic GI complications as consequences of physiological disturbance, e.g. stress ulcers, mesenteric ischaemia and complications originating from extrinsic factors, e.g. instrumentation, drain insertion is infrequently discussed and the potential risks can be equally great if not higher [1].

In particular, as in the patient we presented above, perforation of the GI tract further increases the already-high baseline morbidity and mortality of cardiac procedures [2]. There are several possible causes as to why GI perforation occurs in cardiac surgeries. It can occur intra-operatively from exploration and manoeuvring by surgical instruments, i.e. graspers, dissectors and other operative elements. Post-operatively it can occur without mechanical triggers, such as the many reported cases of stress-related gastroduodenal ulceration [4]. Additionally, mechanical force puncturing the colonic walls is not uncommonly seen at the insertion of a mediastinal drain, which is done routinely in cardiac procedures for free drainage of serosanguinous collection; the drain normally serves to prevent life-threatening complications, e.g. cardiac tamponade. While peptic ulceration develops over days and weeks from physiological stress, mechanical puncture from operative instrumentation and mediastinal drain insertion tends to happen early in the post-operative period. There were several risk factors in our patient. Advanced age with a very thin subcutaneous fat pad along with diverticulosis were the main factors. The patient had also undergone multiple bowel surgeries in the past

and the dense adhesions from previous surgeries had rendered the anatomy rather hostile. These may have made him more vulnerable to this iatrogenic complication despite all preventative measures. It should also be noted that this patient had undergone a redo cardiac surgery and therefore the mediastinum and peritoneum were friable and this could have further enhanced the risk.

That being said, in the case of mediastinal drains, the diagnosis of gastric or colonic puncture is often delayed. In a non-surgical setting, pneumoperitoneum on radiological imaging is diagnostic of bowel perforation, e.g. free air under the diaphragm on a chest X-ray; however, in cardiac operations, air may be introduced into the peritoneal cavity during open thoracotomy or insertion of a mediastinal drain, hence this radiological sign is often unreliable [5]. Additionally, if the puncture site is small with minimal leakage, the obstructive presence of the drainage tube may prevent spillage of bowel content before it even reaches full perforation. All these may not be evident as in the initial post-operative period, the patient may be sedated, intubated and ventilated in the ICU or high-dependency area, the bowel is likely to be empty with minimal bowel content due to nil by mouth, or no drainage from the tube because of blockage or misplacement [6]. Insertion of a mediastinal drain is particularly risky compared to a chest drain for pleural disease due to its proximity to the heart leading to secondary cardiac complications and to the bowel leading to perforation, as a chest drain is routinely inserted along axillary lines where there is a much wider and more flexible access to the pleural space.

When the colon/stomach is perforated, urgent laparotomy with resection of affected segments is warranted. The operation is aimed at identifying the site and extent of the perforation, soiling of the peritoneum and involvement of other organs, which may need specific surgical intervention, e.g. washout, packing as in the case of hepatic haemorrhage and in severe cases splenectomy if the spleen is ruptured. According to Movahedi et al in their study looking at laparotomy for GI complications from cardiac surgery, about 0.1% of patients with GI complications undergo laparotomy [2]. In particular, this group of patients had high morbidity and mortality regardless of whether laparotomy and/or bowel resection was performed.

#### 4. CONCLUSION

In conclusion, in addition to cardiac surgeons, intensivists, anaesthesiologists and perioperative physicians managing cardiothoracic patients must be vigilant to diagnose and treat perforation of the transverse colon in high-risk redo cardiac surgery. A high degree of scientific scepticism based on a strong clinical acumen can avert deleterious consequences. Performing frequent systemic, abdominal and drain site examinations and judicious use of radiological imaging would be imperative. The importance of clinical examination is irrefutable. If diagnosis is ambiguous or the clinical status of the patient deteriorates, early surgical intervention (i.e. laparotomy) would be the appropriate diagnostic and therapeutic measure in addition to removal of the mediastinal drain.

#### CONSENT

Written consent was obtained from the patient for publication of this case report and accompanying images.

#### ETHICAL APPROVAL

It is not applicable.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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