Oesophageal complications after cardiac interventions

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Summary

Gastrointestinal complications after cardiac interventions are rare, but often troublesome. Gastrointestinal bleedings are associated with ischaemic conditions and antiplatelet drugs. Pseudo-obstruction of the intestine and ischaemic transmural lesions occur after heart surgery and the use of heart-lung machine.

Oesophageal perforations after transoesophageal echocardiographies need to be considered in patients with systemic inflammatory syndromes, pleural effusions and sepsis after cardiac interventions. First-line treatment should consist of interventional endoscopy with self-expanding metallic stents, clips, endo-vacuum therapy or their combination. Delayed atrio-oesophageal fistula occurring after intracardial ablative procedures need to be considered, diagnosed by CT scan and best treated by urgent surgery.

Key words: oesophagus; transoesophageal echocardiography; perforation; atrio-oesophageal fistula; complication; cardiac intervention

Introduction

Today all types of cardiac interventions are performed daily worldwide in substantial numbers, thus the absolute amount of associated complications may increase. Although gastrointestinal complications are quite rare with an incidence of 1% [1], cardiologists and non-cardiologists need to be familiar with some distinct features of these diseases.

Each different type of cardiac intervention or cardiac surgery may have particular adverse effects or complications. All interventions share the risk of gastrointestinal bleeding [2], which is slightly increasing in the era of dual platelet inhibition in the last decade [3].

Interventions are divided into diagnostic, surgical and interventional procedures. The latter consist in the most part of percutaneous coronary interventions (PCI) and in a lesser part of intracardiac rhythmological procedures such as ablations.

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Diagnostic procedures with known potential of gastrointestinal complications are transoesophageal echocardiographies (TEE).

The aim of this review was to focus on specific complications occurring within the oesophagus, induced by TEEs and intracardiac ablations. Secondly we discuss treatment options of these lesions.

Other relevant gastrointestinal complications are summarised in an overview chapter at the beginning of this article.

Overview of gastrointestinal complications

Leading complications are gastrointestinal bleedings, which mostly occur with the prescription of an antiplatelet therapy; low dose aspirin is almost always taken by these patients. After application of drug eluting stents during PCI a dual anti-platelet therapy with clopidogrel or newer ADP receptor inhibitors are indicated for some months. In addition warfarin, low molecular heparin or glycoprotein IIIa/IIb inhibitors may be prescribed as well. Gastrointestinal bleeding from ulcerations all over the digestive tract is induced by acute stress reaction due to the acute cardiac disease. In combination with impaired haemostasis, bleeding episodes will often occur more heavily.

Incidence of minor and major bleedings is around 8%, fatal bleeding is rare, but the impact on 30 days mortality is substantial [4]. In the era of proton pump inhibitors, a trend to lower gastrointestinal bleedings is noticed [5].

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Cholesterol embolies after intravascular manipulations are known to cause acute renal insufficiency; elevated counts of eosinophils in blood serum or even in the urinary sediment may present as subtle signs for this often misdiagnosed situation. Cholesterol embolies occur also in the gastrointestinal tract, although rarely diagnosed [6–8].

Complications after cardiac surgery are rare. Incidence is low at 0.5–3% [9, 10], but mortality exceeds 50%. Besides gastrointestinal bleeding, ischaemic events of the small and large bowel leading to paralytic ileus or secondary bleeding are severe diagnoses responsible for mortality. Rarely acalculous cholecystitis or hepatic dyfunction are sequelae of the compromised perfusion.

Acute colonic pseudo-obstruction is a very rare complication after coronary artery bypass operations [11] and may occur as well after heart transplantation [12] or open heart surgery [13]. Symptomatic abdominal distension develops over 3–7 days with clinical features such as abdominal pain, distension, nausea and vomiting. Diagnosis is made by plain abdominal X-ray, showing colonic dilatation predominantly right-sided [14]. Intervention is needed, if distension exceeds 12 cm diameter of the cecum. Initial therapy of choice is application of intravenous neostigmine [15], followed by endoscopic insertion of decompression tubes and, in case of treatment failure, percutaneous cecostomy [16] or even resection.

Long-term complications after abdominal aortic replacement surgery are secondary aorto-duodenal fistulas [17]. The most important diagnostic clue of this highly lethal disease is to be aware of it, especially after decades. A bleeding shock in patients with prior history of abdominal aortic repair, open or interventional, is the typical clinical presentation. Diagnostic workup is done by CT scan with i.v. contrast. An endoscopy has to exclude alternative diagnoses, but is of little value to prove the endoluminal defect. No endoscopical procedure exists to seal the lesion, and surgical repair is urgently indicated.

TEE-associated injuries, namely perforations and atrio-oesophageal fistulas (AEF) after thermal ablations in the left atrium, are particular clinical pictures, which need to be reviewed in detail in the following two chapters.

TEE-associated injuries

Echo probes are inserted routinely without optical or radiological guidance. This technique is safe in properly trained and experienced hands, if some crucial points are respected, however patient history may point out some risk factors and during the examination, red flags have to be recognised. These two facts are discussed later in chapter Prevention.

Figure 1
Fresh mucosal injury.

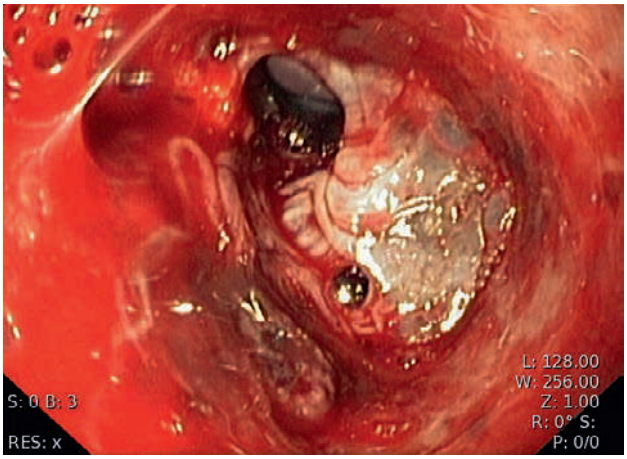
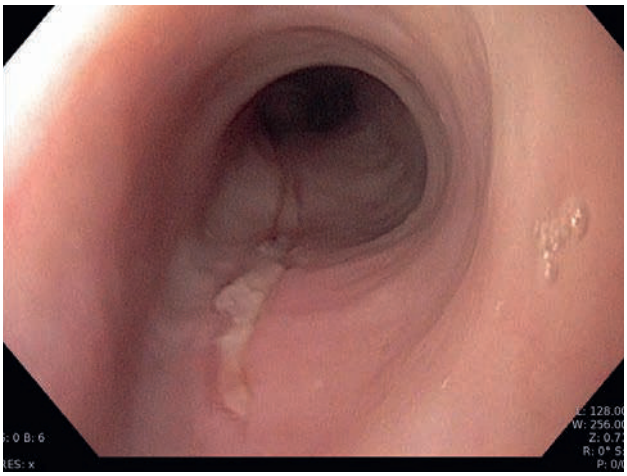


Figure 2
Thin longitudinal healing.



A correctly performed TEE can lead to simple mucosal tears without signs or symptoms, these lesions may be overlooked in the vast majority of cases. If the probe shows traces of fresh blood, diagnostic gastroscopy should be performed. Shearing force induced mucosal lesions look scary (fig. 1), but may heal without any sequelae within days (fig. 2). Perforation is the most feared complication, sometimes diagnosed immediately but more often with a delay of days up to weeks. Incidence of TEE-associated perforation is low at 0.03–0.09% [18–20], but its mortality is very high, if not or late diagnosed. One mechanism to induce oesophageal injury is obviously direct mechanical force. Prolonged continuous pressure during heart surgery without change of position is discussed as an alternative cause, although animal models could not prove this theory [21]. Vibrations of the piezoelectric crystals at the instruments tip may produce thermal injury and adja-

cent tissue absorbs energy of the ultrasound beams. About three quarters of all published lesions happened after intraoperative TEE in mechanically ventilated patients and about two thirds had no risk factors nor were manipulation difficulties recorded. The most important step in patient management is always the establishment of the diagnosis itself. As diagnostic time can cause delay for weeks [22], responsible doctors on the ward and the ICU have to be alert under the following circumstances. In patients with unexplained pleural effusion not resolving under targeted treatment, sustained SIRS or sepsis after a TEE examination even weeks before, an oesophageal perforation needs to be excluded or proven actively. Best diagnostic tool therefore is a flexible video endoscopy, having all endoluminal tubes removed to guarantee a proper examination of the mucosa. Lesions are mostly located in the cricopharyngeal segment after TEE in the nonoperative setting. These patients do have leading symptoms, which hinder a diagnostic delay. Perforation sites in patients after intraoperative TEE are often located in the mid-oesophageal part around 30 cm from teeth.

The best treatment is not standardised nor do accepted guidelines exist for these lesions.

Besides conservative management with nil per os, broad spectrum antibiotics/antifungals, decompression tubes and large bore chest drainages, operative treatment is reported to be the preferred approach. Direct

Figure 3
Established midesophageal perforation.

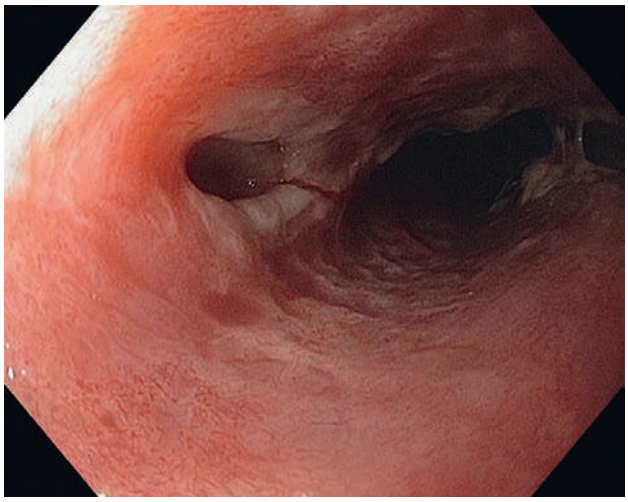


Figure 4
Closure with an over-the-scope-clip.

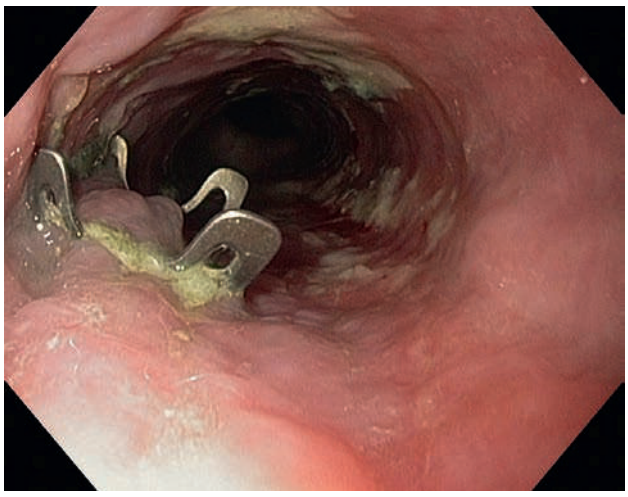


Figure 5
Large esophageal dehiscence.

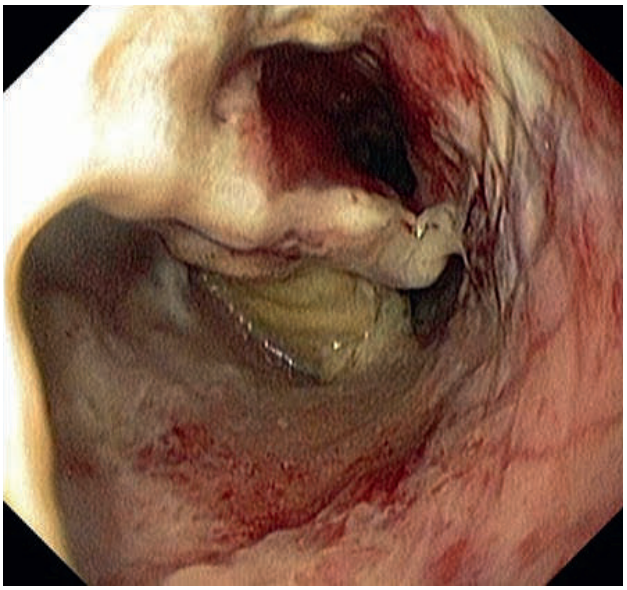


Figure 6
Stent to seal lesion in figure 5.

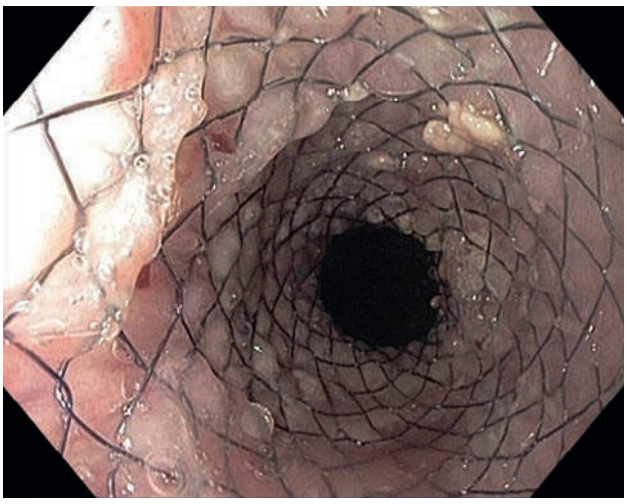


Figure 7
Vacuum sponge within the lesion, imprints of the removed stent.

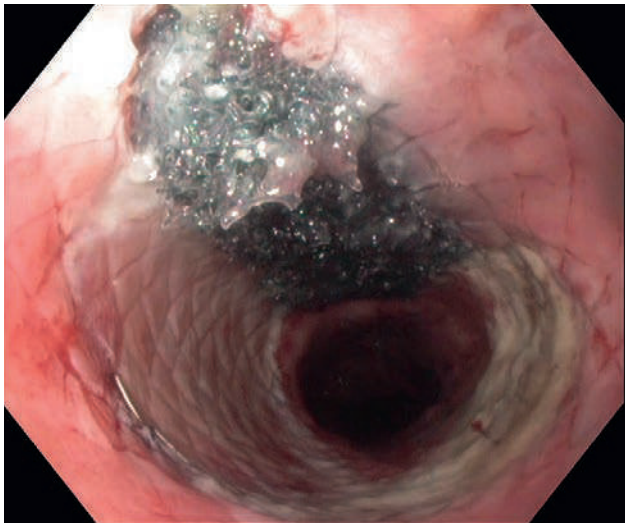


Figure 8
After removal of the sponge.

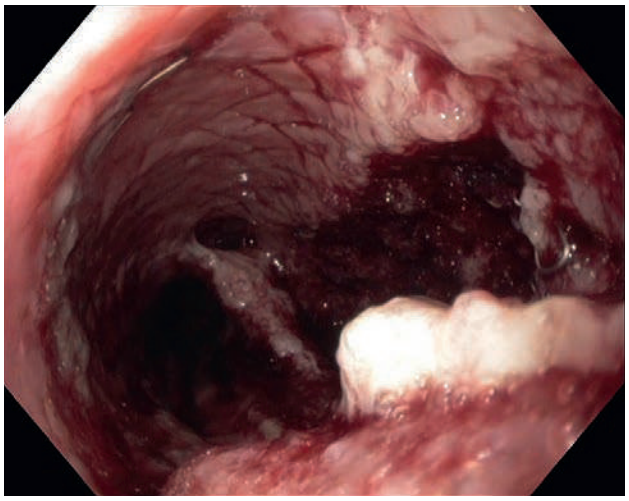


Figure 9
Fibrinous scar developed weeks after closure of the perforation.

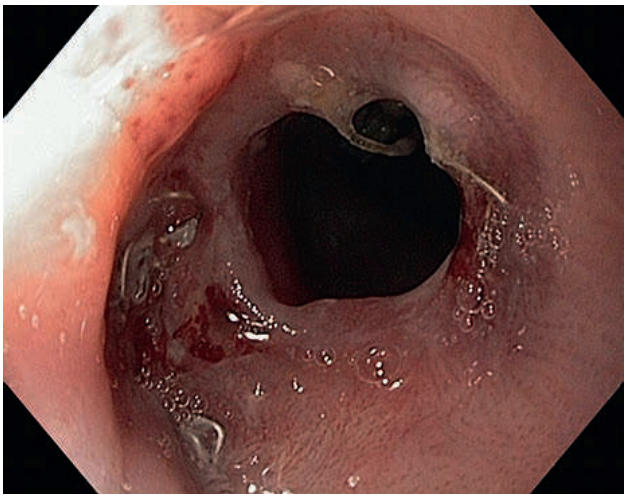
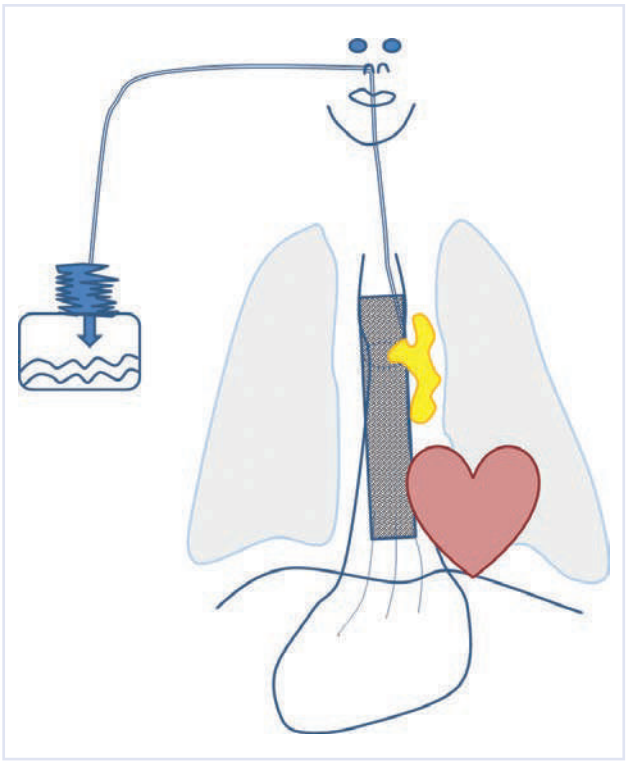
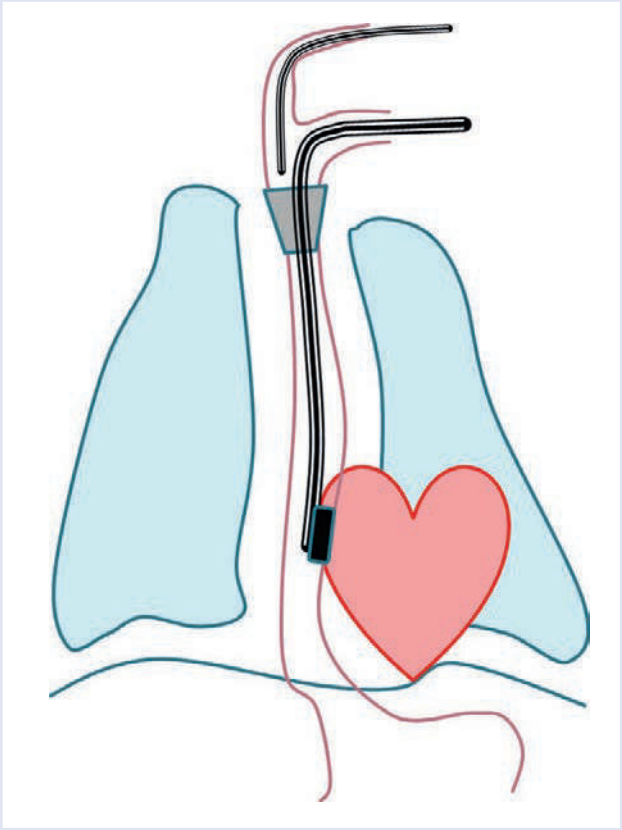


Figure 10
Scheme of the endo-vacuum treatment: stent over sponge.



suture in the cervical part of the oesophagus, resection or diversion was recommended in the past on an individual basis in each patient [23, 24], although newer publications already showed a trend toward the so-named "aggressive conservative approach" [25] without any surgical procedure. We believe that this concept should be even more aggressive and therefore combined with thoracoscopic evaluation and placement of chest drainages alongside an endoscopic closure of the oesophageal lesion. It could be named "aggressive interventional approach". To close defects from the luminal side, self-expanding metallic stents (SEMS) have been used with success in some cases [26–29]. Two large cohorts which analysed the efficacy of stenting in benign oesophageal lesions, could prove a success rate of 79% and 78% respectively [30, 31]. This case series had subgroups with TEE-induced lesions, which could be sealed successfully in about 60%. Particular patients, who had a perforation not closed after stenting, are not deemed to be operated in our own experience, but will need an add-on endoscopic treatment modality such as over-the-scope-clips (OTSC) or an

Figure 11
Side by side nasal endoscopy to guide TEE insertion.



endo-vacuum treatment. OTSC are large clips, which are mounted on the outer part of the endoscope able to grasp large volumes of tissue. They were introduced into humans in 2007 [32] and this clip has proved its efficacy to close perforations all over the gastrointestinal tract [33–35]. Oesophageal perforations remaining closed were reported in the literature recently in over 10 cases [36–38] and in our own experience we could close 7 of 14 oesophageal perforation of different aetiologies (data not published). A successful closure of such a lesion is shown in figure 3 and 4. If the defect itself exceeds 2–3 cm, an endo-vacuum treatment may be an option. A sponge will be placed by endoscope into the lesion of the oesophagus and mediastinum, suction applied on the transnasal tube [39]. Vacuum treatment combined with an over-stenting to seal the cavity seems to be a promising option [40]. Figures 5–9 show a lesion initially treated by stenting, finally closed after add-on of the sponge system (fig. 10).

Atrio-oesophageal fistula (AEF)

Fistula from the left atrium to the oesophagus is the second most frequent reason for mortality after radio frequency ablation procedures and occurs 2–6 weeks after the intervention [41, 42] with a high fatality rate of up to 100%. Cases of death are cerebral air embolisation, septic shock or massive gastrointestinal bleeding. Closed anatomy of the posterior oesophageal wall to the left atrium may lead to unintended temperature elevation during the procedure. This injury leads to a trans-mural defect with an estimated incidence of 0.015–0.04% [43]. Typical symptoms are fever, leukocytosis, dysphagia, chest pain and later in the course neurologic signs such as confusion, limb palsy and seizures. Again, as in the management of TEE associated lesions, time to diagnosis is of utmost importance. Days to weeks after radiofrequency treatments in the heart, clinicians should promptly think about it and actively exclude or confirm the diagnosis.

The method of choice is a CT scan with oral and intravenous contrast, but some lesions may not be detected initially, are false-negative [44] and are therefore to be repeated, if strong clinical suspicion persists. Regular endoscopic examinations are contraindicated and have to be avoided. If there is doubt about a lesion and endoscopic evaluation needs to be performed, we propose an immersion oesophagoscopy. The patient has to be intubated to protect their airways and the endoscopy is performed using water instead of air. Some argue that air insufflation bears a high risk of embolism, as reported in case reports [45]. On the other hand, few cases with successful oesophageal stenting are reported, thus generating conflicting data about the optimal treatment. Collecting the available few data, stenting may be considered in cases of perforation without an established fistula tract. All patients with a fistula didn't survive without surgery. In line with this outcome comes the study of Mohanty et al. A total of 5 patients with AEF treated endoscopically with stenting died within one week and all 4 surgically treated patients survived.

Prevention

Patients undergoing a TEE have to be asked about risk factors. Established risk factors [46, 47] are listed in table 1. Preoperative elective endoscopy has to be performed with a low threshold. If relevant conditions

Table 1
Risk factors for TEE-induced oesophageal perforation.

Zenker's diverticulum
Oesophageal stenosis
History of oesophageal surgery
Prior chest radiation
Endoluminal mass such as tumors
Mucosal diseases such as: eosinophile oesophagitis, severe oesophagitis
Extrinsic compression (mediastinal tumor, aneurysmata)

such as diverticula or a stenosis are detected, TEE should be omitted, if possible or a side-by-side transnasal endoscopy to guide the echo probe is necessary (fig. 11). Adequate sedation in the nonoperative setting is necessary to prevent excessive gaging and spasms of the cricopharyngeal muscle.

Prevention of radiofrequency induced oesophageal lesions is of major concern nowadays. The commonly used clinical strategy is reduction of power magnitude and duration of ablations. Optimising of the oesophageal position in correlation to the atrium or use of cooling balloon within the oesophageal lumen are attempts to minimise the risk although their efficacy remains controversial. General anaesthesia seems to increase the risk [48], and inversely use of acid suppression may lower it [49]. All specific strategies are extensively reviewed in the article of Liu [50].

Conclusion

Besides gastrointestinal bleedings, complications associated with cardiac interventions are rare, but often life-threatening. Early recognition is of utmost importance and clinicians should be familiar with the particular features of TEE-induced perforation and atrio-oesophageal fistula.

Oesophageal perforation independent of diagnostic delay should be treated by aggressive interventional endoscopy. Stenting combined with insertion of chest tubes by thoracoscopy should be performed and escalation with advanced endoscopic closure techniques such as OTSC or endo-vacuum may be necessary.

AEF on the other hand needs urgent surgical repair; diagnostic or therapeutic endoscopy is dangerous.

Preventive measures may lower the incidence for both diseases significantly.

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