

Acute mesenteric ischemia after cardiac surgery. Role of the abdominal compartment syndrome treatment.



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Acute mesenteric ischemia after cardiac surgery. Role of the abdominal compartment syndrome treatment.

BACKGROUND: *The management of abdominal compartment syndrome (ACS) has been included as a standard of care in our therapeutic algorithm after diagnosis of acute mesenteric ischemia (AMI), following cardiac surgery. This report is an updated review of our results compared to previous experience.*

MATERIALS AND METHODS: *A retrospective, observational, cohort study on a series of 26 patients (20 males, 6 females, mean age 75.2 years, min 64, max 83) who developed AMI, out of 7.719 patients undergoing cardiac operations (January 2005 – December 2014). The initial treatment consisted of laparotomy with abdominal decompression and temporary abdominal closure, performing visceral resections just in case of gangrenous tracts and providing for a “second-look” during the variable period of resuscitation and vacuum assisted dressing.*

RESULTS: *A non-occlusive mesenteric ischemia with diffuse visceral underperfusion was confirmed in every case. Temporary abdominal closure was applied to treat ACS in every case, 13 patients required associated resection of gangrenous tracts (50%). Seventeen patients died following first operation as a consequence of multiple organ failure (65.4%). Nine patients survived (34.6%) and underwent re-establishment of intestinal continuity and definitive closure of abdominal wall within 30 DAYS.*

DISCUSSION AND CONCLUSIONS: *AMI occurring after cardiac surgery is associated with an increase of intra-abdominal pressure and subsequent ACS. Basing on this case series, an early ACS treatment using open abdomen techniques may be results in a better outcome of critically injured cardiac patients. These results compared favourably with literature experiences (mortality rate > 85%).*

KEY WORDS: Abdominal compartment syndrome, Acute mesenteric ischemia, Cardiac surgery

Introduction

Acute mesenteric ischemia (AMI) after cardiac surgery is an extremely challenging condition, occurring after 0.5% to 1% of all heart procedures with subtle clinical presentation, late diagnosis, and difficult algorithm of treat-

ment¹⁻³. Among the abdominal surgical catastrophes, AMI occurring after cardiac operations has one of the highest rate of mortality, ranging from 70% to 100%⁴⁻⁶.

Unlike standard contexts (i.e. thromboembolic mesenteric infarction) AMI following cardiac surgery is due to non-occlusive ischemia and a single staged procedure with vascular repair and immediate bowel resection is rarely advisable because of unclear limits of intestinal malperfusion, deranged abdominal physiology, high intra-abdominal pressure and clinical signs of multiorgan dysfunction. Basing on new concepts concerning abdominal compartment syndrome (ACS), during the last 9 years we have included the treatment of high intra-

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abdominal pressure as a standard of care in our therapeutic algorithm after diagnosis of AMI. This report is an updated review of our results compared to previous experience.

Materials and Methods

A retrospective, observational, cohort study was undertaken collecting clinical data on a series of 7.719 patients undergoing coronary artery bypass grafting and/or ascending aorta replacement and/or valve procedures (january 2005 – December 2014). The study population consisted of 26 patients (20 males, 6 females, mean age 75.2 years, min 64, max 83) who developed AMI after cardiac operations and underwent surgical treatment. AMI was clinically suspected in patients who needed inotropic drugs to support the hemodynamic status, presenting with a distended abdomen in Intensive Care Unit within first 48 hours after cardiac procedures. The diagnosis was confirmed by abnormal lab values (metabolic acidosis, high levels of blood lactates and rising trend of visceral enzymes) and presence of ACS, defined as a sustained intra-abdominal pressure > 15 mmHg associ-

ated with new organ dysfunction/failure, according to World Society of the Abdominal Compartment Syndrome guidelines⁷. A CT-scan was planned in every case to assess the status of visceral vessels and condition of abdominal organs.

The algorithm of treatment initially consisted of intensive medical and metabolic support including Continuous Veno-venous Hemodiafiltration (CVVHDF) and Coupled Plasma Filtration Absorption (CPFA), but if these measures failed, prompt intervention was considered mandatory (Fig. 1). At the laparotomy, the peritoneal cavity was decompressed and washed, and the abdomen closed with a temporary abdominal closure system by means of dressing suction and vacuum assisted techniques^{8,9}. Visceral resections were performed just in case of gangrenous tracts, with the ends of the intestine placed outside the abdominal wall. The abdominal dressing pack was changed within 48 hours from first laparotomy. A "second-look" visceral assessment was scheduled basing on clinical conditions during the variable period of resuscitation and vacuum assisted dressing, providing for re-establishment of the bowel continuity and abdominal wall closure as soon as possible to prevent visceral damage.

Results

During a nine-years period AMI was observed in 26 out of 7.719 cardiac procedures (0.33%). At laparotomy a non-occlusive mesenteric ischemia with diffuse visceral underperfusion was confirmed in every case. Thirteen patients required resection of gangrenous tracts with single or multiple stomas (50%). Viscerolysis and abdominal decompression without resection were performed in other 13 patients (50%). Temporary abdominal closure

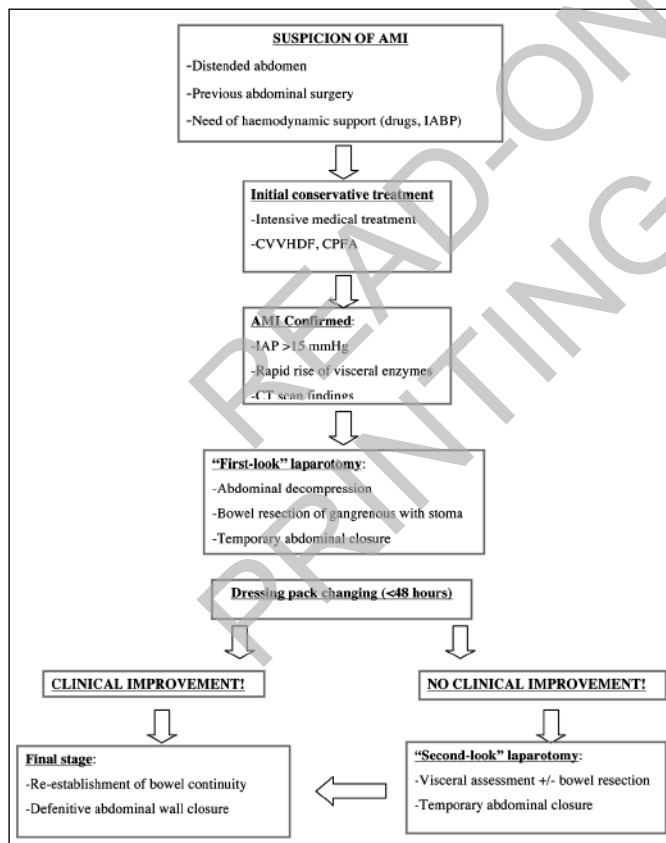


Fig. 1: AMI: Acute Mesenteric Ischemia; IABP: Intra-Aortic Balloon Pump; CVVHDF: Continuous Veno-venous Hemodiafiltration; CPFA: Coupled Plasma Filtration Absorption.

TABLE I

	1991-1999*		2005-2014	
	N.	%	N.	%
Cardiac Operations	3.992		7.719	
Acute mesenteric ischemia	19	0.5	26	0.33
Males	15	78.9	20	76.9
Females	4	21.1	6	23.1
Mean Age	64.8		75.2	
Type of ischemia				
Small bowel	4	21	5	19.2
Large bowel	5	26.3	8	30.7
Massive/diffuse	10	52.6	13	50
Type of operation				
Exploratory laparotomy	14	73.6	0	0
Bowel resection	3	15.7	13	50
Decompression (open abdomen)	1	5.2	26	100
Embolectomy	1	5.2	1	3.8
Death	16	84.2	17	65.3

*Previously published data (2)

was applied to treat ACS in every case, using dressing suction and vacuum assisted techniques (n.23). At the beginning of experience, 3 patients were treated by open abdomen technique without suction or vacuum system. Seventeen patients died following first operation as a consequence of multiple organ failure (65.4%). Nine patients survived (34.6%) and underwent definitive closure of abdominal wall within 30 days. Re-establishment of intestinal continuity was performed in six of them. These results compared favourably with our previous experience reporting higher mortality rate (Table I).

Discussion

AMI is a life-threatening emergency determined by a sudden decrease in the mesenteric blood flow as a consequence of anatomic or functional vascular occlusions, leading to multi-organ failure and death. In standard contexts (i.e. thromboembolic mesenteric infarction) the main course of AMI is related to the site and length of the anatomic vascular occlusion and an early diagnosis associated with prompt treatment enables to reduce the mortality improving the outcome¹⁰⁻¹⁴.

AMI occurring after cardiac surgery is due to non-occlusive ischemia secondary to low cardiac output and mesenteric endothelial dysfunction arising after cardiopulmonary bypass¹⁵⁻¹⁷. The redistribution of the blood flow from the gut, as effect of vasopressors used during cardiogenic shock, powers the mesenteric cellular hypoxia and mucosal dysfunction, with edema and bowel distention, leading to an increase of intra-abdominal pressure and subsequent ACS^{14,18}. In this scenario patients are usually unresponsiveness and the physical examination is equivocal, accounting for delayed diagnosis and worst outcome, with a case-fatality rate close to 100%^{4,6,15}. The intra-abdominal pressure elevation has to be considered a significant marker in case of clinical suspicion of AMI occurring in the early stage of ischemic abdomen in patients undergoing cardiac surgery in which the clinical signs are often misunderstood. As a consequence, the abdominal pressure monitoring must be included in the diagnostic work-up if AMI is clinically suspected, mainly in patients presenting with a distended abdomen who need inotropic drugs to support the hemodynamic status following cardiac procedures. The ACS treatment plays a main role in the therapeutic algorithm of these patients in which a vascular repair and immediate bowel resection is rarely advisable because of unclear limits of intestinal malperfusion, deranged abdominal physiology, and clinical signs of multiorgan failure. An abdominal decompression associated with open abdomen techniques should be routinely performed as first approach to improve the visceral perfusion, preserve the wall integrity, and allow progressive wall closure without hypertension, as we did in this experience according with damage control surgery principles¹⁹.

Basing on the present case series, the combined treatment of AMI and ACS may result in a better outcome following ischemic abdomen after cardiac operations. However, early diagnosis and interdisciplinary cooperation in the provision of treatment are still required if the poor outcome of this condition has to be improved.

Conclusions

The ACS has to be considered a relevant factor for the outcome of cardiac patients affected by AMI. Basing on the present case series, abdominal decompression and temporary abdominal closure using vacuum assisted dressing can be associated with better outcome. However this study is retrospective and this is the main limitation. The number of patients is limited and the observations should be tested on a large population study.

Riassunto

INTRODUZIONE: L'ischemia mesenterica acuta (AMI) può insorgere dallo 0.5 all'1% dei casi dopo interventi cardiocirurgici, comportando una mortalità vicino al 100%. Il trattamento della sindrome compartimentale addominale (ACS), che si associa invariabilmente in questi pazienti, dovrebbe essere considerato nel protocollo terapeutico, per migliorare la prognosi. Il presente studio riporta la nostra recente esperienza in proposito.

MATERIALI E METODI: Studio retrospettivo relativo a 26 pazienti (20 maschi, 6 femmine, età media 75.2 anni, min 64, max 83) su una serie consecutiva di 7.719 interventi cardiocirurgici (Gennaio 2005 – Dicembre 2014), sottoposti a laparotomia per AMI, trattati con decompressione chirurgica e chiusura temporanea addominale. **RISULTATI.** Un'ischemia funzionale era confermata in tutti i casi. In 13 pazienti la decompressione addominale fu eseguita senza resezione viscerale, che si rese necessaria in altri 13 casi. Si sono verificati 17 decessi per insufficienza pluriorganica (65.4%), 9 pazienti sono sopravvissuti e sottoposti a ricostruzione della parete addominale ed eventualmente al ripristino della continuità intestinale entro 30 giorni (34.6%). Questi risultati, anche se difficilmente confrontabili, sembrano incoraggianti rispetto alla pregressa esperienza personale e generalmente migliori dei dati riportati in letteratura nel paziente cardiocirurgico (mortalità >85%).

DISCUSSIONE E CONCLUSIONI: Una complicanza ischemica intestinale dopo cardiocirurgia si associa invariabilmente ad un incremento della pressione endoaddominale, precipitando una sindrome compartimentale. Il riconoscimento precoce di questo evento e l'opportuno trattamento che ne consegue, usando le tecniche di chiusura temporanea dell'addome, sembrerebbero consentire migliori risultati terapeutici in questa severa categoria di pazienti.

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