Acute Bowel Ischemia after Coronary Bypass Surgery – A Catastrophic Event

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ABSTRACT
Acute bowel ischemia is a rare but often catastrophic event after coronary bypass surgery. We report three cases in our department and highlight the difficulty in making the diagnosis thus delaying timely intervention. We discuss why an aggressive approach in both investigating and managing this condition is warranted. We believe that early mesenteric angiogram and directed exploratory laparotomy are the preferred methods in managing this difficult condition.

Keywords: Mesenteric ischemia, mesenteric angiogram, exploratory laparotomy, risk factors

INTRODUCTION
Acute bowel ischemia is an infrequent event (less than 1%) in patients undergoing coronary bypass surgery. However when it occurs it is often lethal. Mortality rates range from 70 - 100%,[1] The difficulty in making the diagnosis contributes heavily to the catastrophic end result. A high index of suspicion is important for an early diagnosis. This is based on noting inherent predisposing risk factors for bowel ischemia and recognizing ongoing clinical events. A mesenteric angiogram should immediately follow to confirm the diagnosis. Then, only with expedient surgery can the patient have any chance of survival. We report three cases in the last two years in our institution. We highlight the reasons for the uniformly dismal outcome and the difficulty in making the diagnosis. Finally, we state the preferred approach in dealing with this difficult condition.

PATIENT AND METHOD
Case 1
A 68-year-old Chinese female had a recent history of an extensive anterolateral myocardial infarction. Her co-morbid state included non-insulin dependent diabetes mellitus and hypertension. Elective cardiac catheterization revealed severe triple vessel disease, anterior wall hypokinesia and ejection fraction of 30%. She experienced severe chest pain and was started on heparin and glyceryl trinitrate without relief until insertion of an intra-aortic balloon pump (IABP). Emergency coronary bypass surgery with 3 bypass grafts was performed. Surgery was uneventful with a cross clamp time of 28 minutes and cardiopulmonary bypass (CPB) time of 55 minutes. She was weaned off CPB with 6 micrograms of dopamine/kg/minute. She was extubated on the first postoperative day (POD-1) with same day removal of the IABP. On POD-8 she developed recurrent atrial fibrillation of 150 beats/min with a blood pressure of 100/80 mm Hg. Intravenous amiodarone was started. Her total white cell count (wbc) climbed to 19800/ml on POD-9 and she became febrile with a temperature of 38°C. Blood and stool cultures were negative for bacterial growth. On POD-13 she complained of left flank pain. Investigations revealed a serum amylase level of 87iu/L and urine examination showed 100-200 red blood cells/ml. Her abdominal signs were unremarkable. Her white cell count was now 25900/ml. Later that night she became breathless with severe abdominal pain. Her abdomen was distended without guarding or rebound tenderness. Her plain abdominal films revealed only dilated loops of small and large bowel. She deteriorated and required intubation POD-14. Her pre-intubation blood gas was pH 7.45, P02 41.2 mm Hg, PC02 34.5 mmHg, standard HC03 24.4 mmol/L. She became comatose with a white cell count that was now 33,800/ml. Finally an exploratory laparotomy was made and this revealed hemoperulent fluid with small bowel necrosis from distal jejunum to terminal ileum and ischemia of the ascending colon. In view of extensive bowel infarction, the abdomen was closed and she died from multi-organ failure with intractable acidosis.

Case 2
A 65-year-old Chinese male had chronic stable angina for five years. His co-morbid state included hypertension, hyperlipidaemia and end stage renal
failure due to chronic glomerulonephritis. The cardiac catheterization revealed severe triple vessel disease. The EF was 40%. The abdominal aorta was very tortuous. Whilst being prepared for surgery, he threw a generalized tonic-clonic fit. There was no residual neurological deficit. Electroencephalogram showed no epileptic activity and the CT scan of the brain was negative for infarction. He underwent coronary bypass surgery two days later with pre-operative haemodialysis. Operative findings included plaques at the innominate artery and aortic arch. Five bypass grafts were performed. Clamp time was 64 minutes and CPB time was 113 minutes. He was extubated on POD-1. On POD-2 he became confused and disorientated. Serum amylase was 240 iu/L. On POD-2, left lower quadrant tenderness developed. Per rectal examination was unremarkable. The arterial blood gases revealed pH 7.23, BE -9.3 mmol/L, HCO3 17mmol/L. A mesenteric angiogram was immediately ordered. This revealed a patent proximal main SMA with a dearth of ileal branches (Fig. 2). The right colic and middle colic arteries were absent. The superior mesenteric vein was patent 120 mg of intra-arterial papaverine was infused with some improvement (Fig. 3). Emergency laparotomy revealed the following: proximal jejunum had patchy bruising and petechial staining. 4 cm of distal ileum was infarcted. Segmental arterial pulsations were weak. Resection of non-viable bowel was done. The next day he developed ventricular tachycardia requiring electrical defibrillation. He remained on adrenaline 0.2 ug/kg/min and dopamine 7 ug/kg/min. His blood pressure remained 80 to 90 mmHg systolic. The drain revealed bloody fluid. A planned second look was not done due to the reluctance of the anaesthetist and general surgeon to proceed in view of his poor haemodynamic state. He developed
DISCUSSION

It is a well known that acute bowel ischemia is often a lethal event. The patho-physiology of bowel ischemia is complex and multifactorial. Acute bowel ischemia, of arterial origin, falls into two broad categories: occlusive ischemia due to thrombosis or embolism (70%) and non-occlusive ischemia (30%) seen in “shock-bowel” syndrome and “low-flow” syndrome where high dosages of vasoconstricting agents are often used in haemodynamically unstable patients. Conditions that are predictors of susceptibility to thrombo-embolism include diffuse arteriosclerotic disease (the arteriopath), hypertension, diabetes mellitus, hyperlipidaemia and apoplexy. The risk of embolization is also high with interventions in an atherosclerotic or tortuous abdominal aorta. The use of the intra-aortic balloon pump is known to cause embolic showers especially if placement is difficult, requiring excessive manipulation in a diseased aorta. Cardiac catheterization too may effect embolic showers causing trash feet and mesenteric vascular occlusion. Commonly used drugs such as digoxin, epinephrine, norepinephrine and high doses of dopamine are known to cause or potentiate mesenteric vasoconstriction. Chronic dialysis patients are known to be susceptible to non-occlusive mesenteric ischemia.

In case 1, the predisposing risk factors were age, a moderately impaired ejection fraction, diabetes and hypertension. Ongoing clinical events that predisposed to thrombo-embolism were the use of an IABP and recurrent atrial fibrillation with hypotension on POD-8. Fever, severe leukocytosis and flank pain with minimal abdominal signs on POD-13 should have raised the suspicion of bowel ischemia. Delaying the decision to explore her abdomen until acidosis and collapse not surprisingly proved fatal. Frank bowel necrosis had already occurred. The plain abdominal film and serum amylase levels were not helpful.

In case 2, the predisposing risk factors were age, hypertension, hyperlipidaemia, end-stage renal failure, a tortuous abdominal aorta and atherosclerotic plaques in the arch of the aorta. Ongoing clinical events such as cannulation of the atherosclerotic aorta with possible “sandblasting” effect could have caused intra-and peri-operative dislodgement of atherosclerotic debris. On POD-4, significant abdominal signs had developed with a temperature of 38ºC, leukocytosis of 21560/ml and acidosis. Exploratory laparotomy was again delayed. Despite a successful embolectomy of the SMA, the patient succumbed to intractable shock.

In case 3, the predisposing risk factors were age, hypertension, hyperlipidaemia and chronic renal failure. Ongoing clinical events were the IABP insertion in a tortuous aorta, a complex redo cardiac operation with a long CPB time and the attempt to adjust the position of the IABP postoperatively. The latter caused dislodgement of atherosclerotic debris as evidence from the trash feet. Further, he developed abdominal pain after balloon removal.
with a raised serum amylase. This should have raised
the suspicion that mesenteric embolism had
occurred. A one day delay in doing the mesenteric
angiogram proved fatal. The angiographic picture
was consistent with embolization to the SMA and
its distal circulation. Intra-arterial papaverine was
partly successful in relieving the associated
vasospasm but laparotomy revealed infarcted distal
terme. Unfortunately the patient was not brought
back for a second look operation. The second
operation was certainly indicated in view of the
uncertain viability of unresected bowel. The patient
succumbed to intractable acidosis. The 3 cases
demonstrate that without a timely diagnosis, this is
often a lethal event. Unfortunately establishing an
early diagnosis is difficult. Apart from abdominal
pain, there are usually no abdominal signs till
established bowel infarction has occurred. The pain
however is characteristically out of proportion to the
physical signs. In the plain abdominal film, apart
from non-specific dilated loops, there are no other
signs until pneumotosis, frank perforation or portal
venous gas develop. “Thumb-printing” and formless
loops of small bowel can sometimes be seen due to
mucosal edema and haemorrhage. However this
usually signifies infarction. The serum amylase is not
always raised and is non-specific. A leukocytosis
exceeding 15,000/ml and severe metabolic acidosis
may occur in only 50-70% of patients with acute
ischemia. In view of the lack of characteristic clinical
symptoms and signs in the early phase of bowel
ischemia, the only way to come to a diagnosis is
to have a high index of suspicion. Each patient
should be looked at from the point of having any
predisposing factors and then taking notice of
significant ongoing clinical events that may
precipitate bowel ischemia. Once suspicion is
aroused, it is mandatory to be aggressive in pursuing
a mesenteric angiogram. The angiogram may be
therapeutic when coupled with intra-arterial
papaverine for non-occlusive ischemia. If occlusive,
it may reduce concomitant vasospasm, limiting the
extent of infarction. Immediate selective laparotomy
can be planned. The alternative to an aggressive
approach usually meets with a lethal outcome. Most
literature reports cite a mortality of close to 90%
when the diagnosis is delayed(9). Thus in order to
salvage these patients, early mesenteric angiogram
should be done, accepting a fair number of negative
studies. Boley has shown(5) that the mesenteric
angiogram is the preferred investigative modality.
He achieved a 54% survival rate in 35 cases of
bowel ischemia. The survival rate in non-occlusive
ischemia was 60%. In another review(7) he achieved
a 55% survival in cases of embolism to the SMA
where angiogram was followed by intra-arterial
papaverine and selected laparotomy. The alternative
“traditional” methods resulted in 80% mortality.
Other diagnostic modalities have been advocated.
Duplex examination is not always possible as
distended bowel prevents adequate visualization.
Peritoneal lavage for white and red cell counts and
amylase levels gives positive results only in the late
phase9. Laparoscopy may be helpful but raising the
intra-abdominal pressure beyond 20 mm Hg is
detrimental and worsens bowel ischemia. Also
dilated loops may preclude adequate examination.

Finally it is imperative that the surgeon takes
precautionary measures. Quick surgery (shorter
CPB times) should be performed with higher
perfusion pressures in patients who have
predisposing risk factors especially advanced age and a
heavy atherosclerotic load. Maintaining optimal
haemodynamics, correcting aggressively arrhyth-
mias especially atrial fibrillation, use of systemic
vasodilators such as calcium channel blockers and
nitrates and expeditious removal of balloon pumps
are important postoperative measures.

As Singapore’s population rapidly ages and with
the ready availability of cardiovascular services, more
elderly patients will undergo coronary bypass surgery.
Many will have risk factors that when combined with
a triggering event result in acute intestinal ischemia.
Some of these patients will even have stormy
postoperative courses and require extraordinary
cardiopulmonary support only to present with acute
bowel ischemia. It is therefore imperative that the
attending cardiac surgeon have in place, a working
algorithm, to make an early diagnosis thus allowing
rapid intervention.

CONCLUSION

In conclusion, only 3 factors can make a difference
in the outcome of acute intestinal ischemia after
coronary bypass surgery. They are a high index of
suspicion, an aggressive investigative protocol utilizing
early mesenteric angiograms and timely intervention
involving a combination of intra-arterial papaverine
and exploratory laparotomy.

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Symposium On Anterior Knee Pain

24 February 2001, Saturday
12.00pm to 5.00pm
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