Case Presentation

- A 69 Yrs. old gentlemen, 52 Kg, BMI: 18.5
- DOE FC: II-III
- PMH: DM, HTN, Smoking & Hx of laparotomy!
- Drug Hx. : Beta –blocker , ACE inhibitor, Glibenclamid, Atorvastation
- CXR: mild cardiomegaly
- ECG: NSR, no ST-T changes
- TTE/TEE: Bileaflet mitral valve prolapse, Sever MR, LVEF=50%, PAP=35, no clot in left side chambers

GI problems in Cardiac disease Symposium

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Tehran 1389

- Cath. Report: NECA
- Carotid Doppler: Normal
- PFT: FEV1=2.72, 93%
- Lab tests: Hgb:12.8% Hct:36.8,
  WBC: 5800 PMN:46%
  FBS:112, HbA1c:6.5
  Other tests in normal ranges

Cardiac Surgery

- MV repair CPB time:79 min, AOX: 39+18min
- IOTEE: LVEF: 40%, Sever SAM, Mod MR

- Re-repair, mitral ring was replaced by larger one
- IOTEE 2: LVEF 45%, No SAM, Trivial MR

Intra-op ABGs

	PH	Po2	Pco2	HCO3	BE	Na	K	HCT	BS	Lactate	MANAGEMENT
Baseline	7.41	80	37	23	0	136	3.3	38	92	0.6	10 Meq KCL
Pump 2	7.42	275	35	23	-1	130	5.6	21	180	2.3	1 Packed cell+ 10 insulin
End of surgery	7.23	245	39	16	-10	133	4	32	140	3.9	50 cc NaHco3

ICU Stay

- Transfer to ICU with stable hemodynamics and no Inotropic agents at 12: 30
- BP= 100/65, HR=80 on TPM, CVP=13 no drainage
- SIMV, 60%, 600 cc, 12, no PEEP

	PH	Po2	Pco2	HCO3	BE	Na	K	HCT	BS	Lactate	MANAGEMENT
12:30	7.22	144	41	18	-1	145	3.4	30	102	-	SIMV 50%
2 pm	7.19	184	45	18	-10	136	3.6	31	124	-	50 cc NaHco3+ 10 Meq KCL
4 pm	7.23	143	32	14	-13	145	4.4	29	-	-	100 cc NaHco3

ICU Stay

- 5pm:

  BP=80 HR:80 TPM CVP=14

  mediastinal drainage =350 cc

  2 gr. Fibrinogen Based on ROTEM

  Epinephrine: 0.05 micro/kg/min

  1 unit packed cell

	PH	Po2	Pco2	HCO3	BE	Na	K	HCT	BS	Lactate	MANAGEMENT
6 pm	7.23	145	39	16	-11	145	3.4	27	261	-	50 cc NaHco3+ 10 insulin
12 pm	7.11	107	36	11	-17	148	3.9	32	137	-	100 cc NaHco3 Epi:0.2 Levo: 0.05

BP=80/40 HR:96 CVP:15 Total Drainage: 500cc
Hgb=11.2 urine output : Ok

CXR & ECG: No new Finding
TTE: LVEF 40%, Mild MR, No PE, No SAM

Extremity: Normal, Good distal pulses and capillary refill
CBC: WBC=10800 PMN=80% Hgb=12.8
NG tube: No bleeding
Abdominal Exam: No distention, No pain (Unreliable due to IV sedation)
Rectal Exam: no problem

8 am in ICU

- BP= 90 HR=100 CVP=12 U/O = Ok

	PH	Po2	Pco2	HCO3	BE	Na	K	HCT	BS	Lactate	MANAGEMENT
8 am	7.03	89	36	10	-20	155	4.7	29	95		100 cc NaHco3 Epi:0.2 Levo: 0.05
11 am	7.02	84	36	9	-20	158	4.5	26			100 cc NaHco3 Epi:0.2 Levo: 0.05

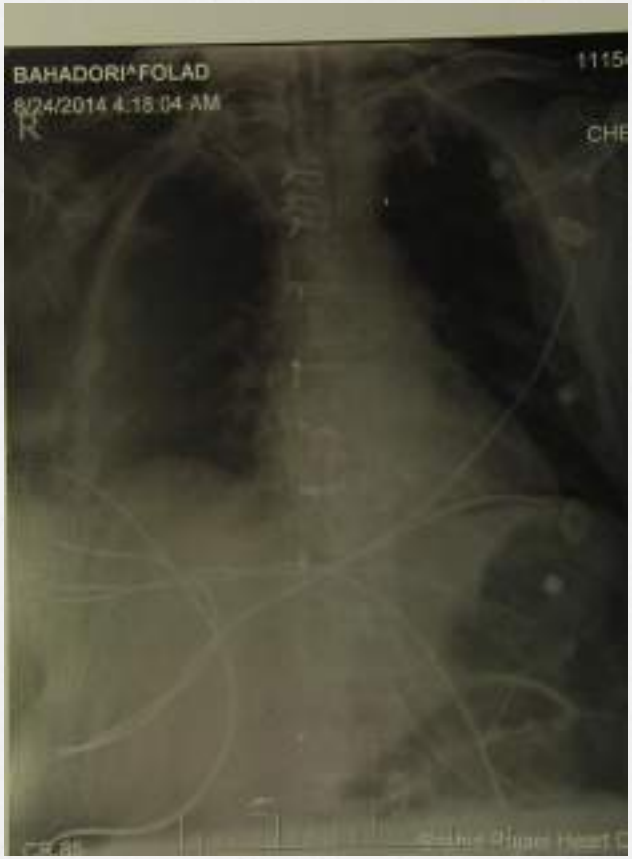
- TTE: LVEF 25%, trivial MR No PE
- CXR: no new finding
- Cr: 1 CPK= 458 SGOT= 750 SGPT=456 LDH=2235 Bil=6.2
- Abdominal exam: Mild Distension , No acute abdomen
- Abdominal USG or X-ray: unfeasible
- GI consultation + CBC diff recheck

2 pm in ICU

	PH	Po2	Pco2	HCO3	BE	Na	K	HCT	BS	Lactate	MANAGEMENT
2 pm	7.01	68	33	9	-21	158	4.8	27	-		100 cc NaHco3 Epi:0.2 Levo: 0.05
Last ABG	7.00	67	25	6	-25	158	4.5	26			100 cc NaHco3 Epi:0.2 Levo: 0.05

- WBC: 18300 PMN: 89%

Post op 1 CXR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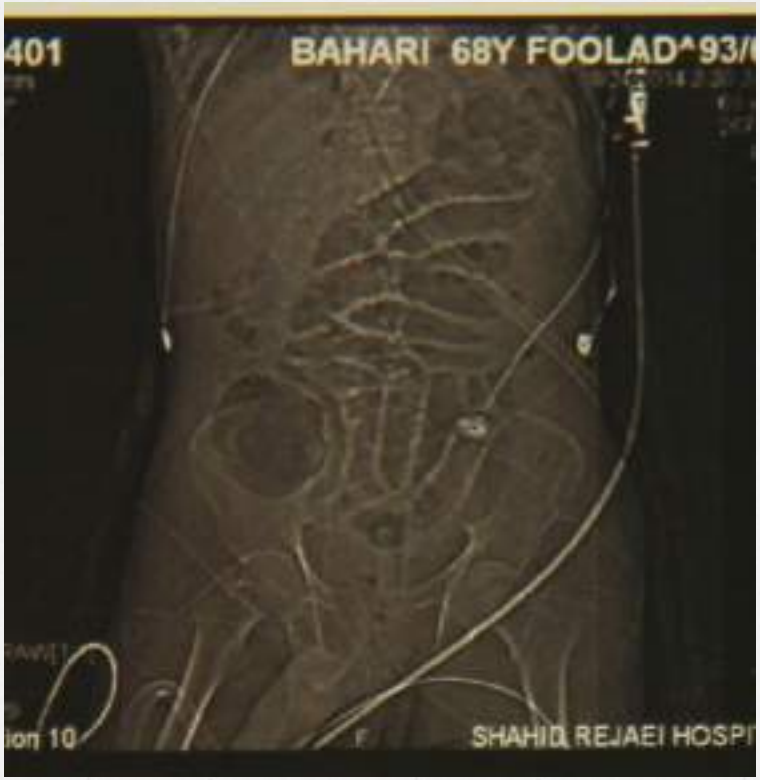
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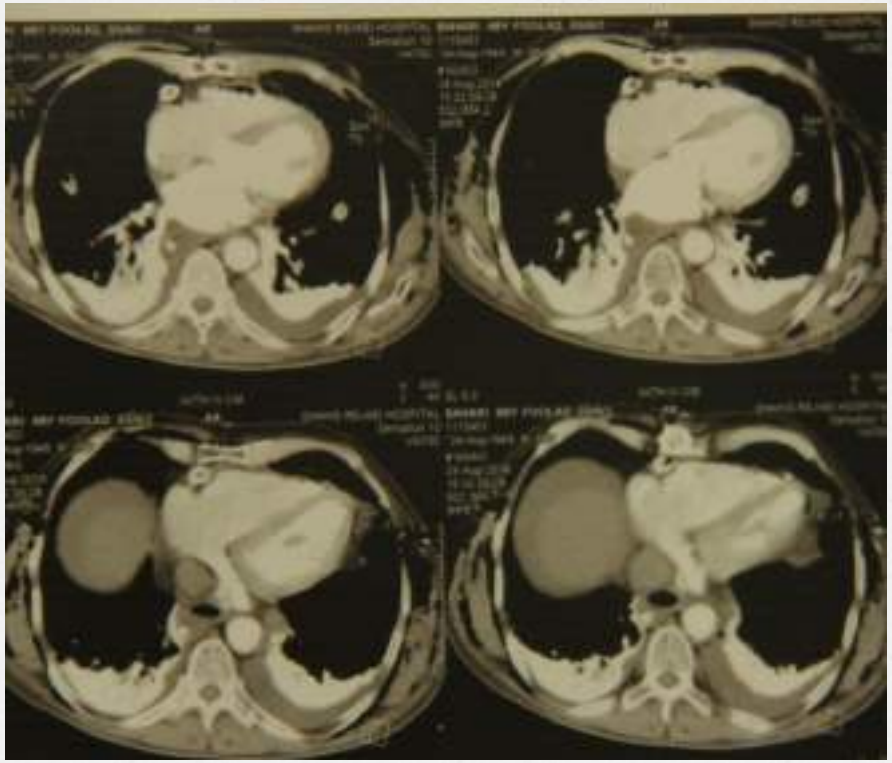
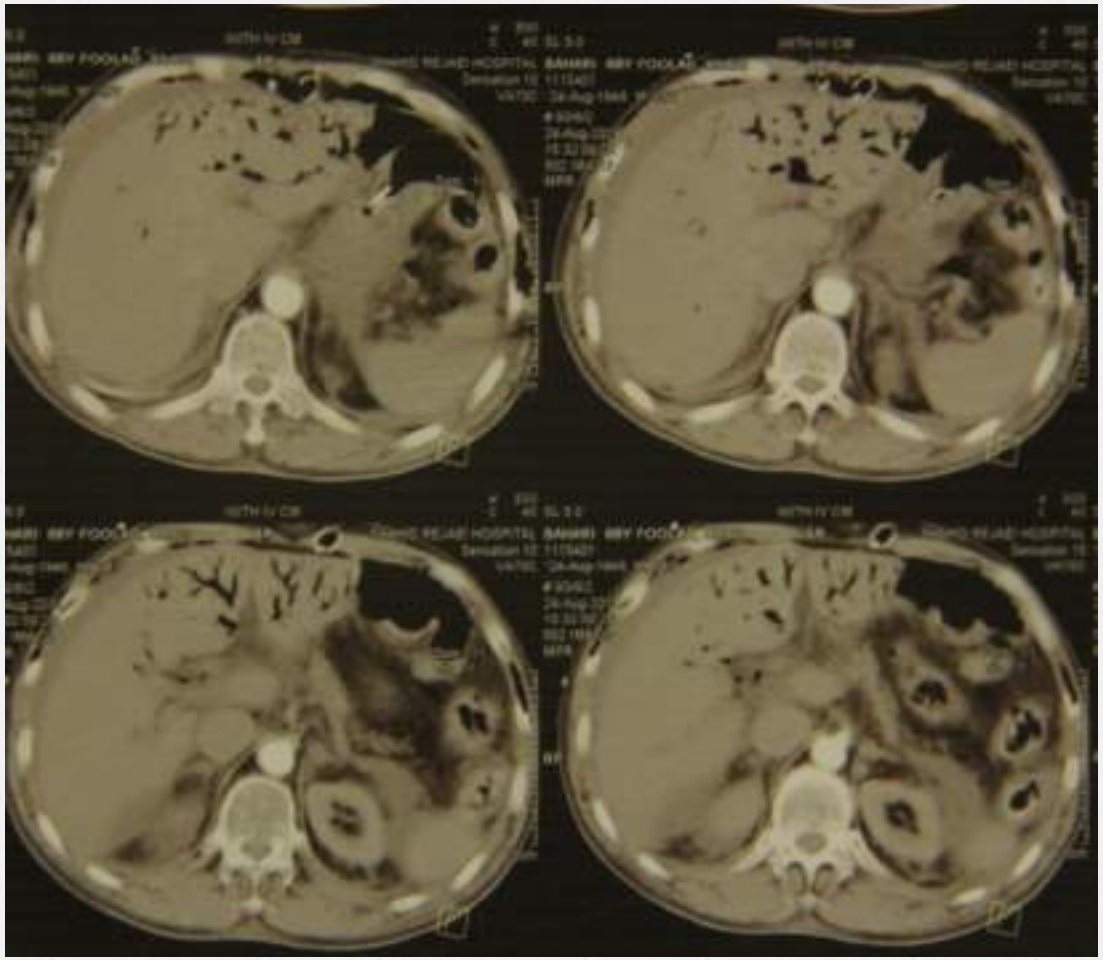
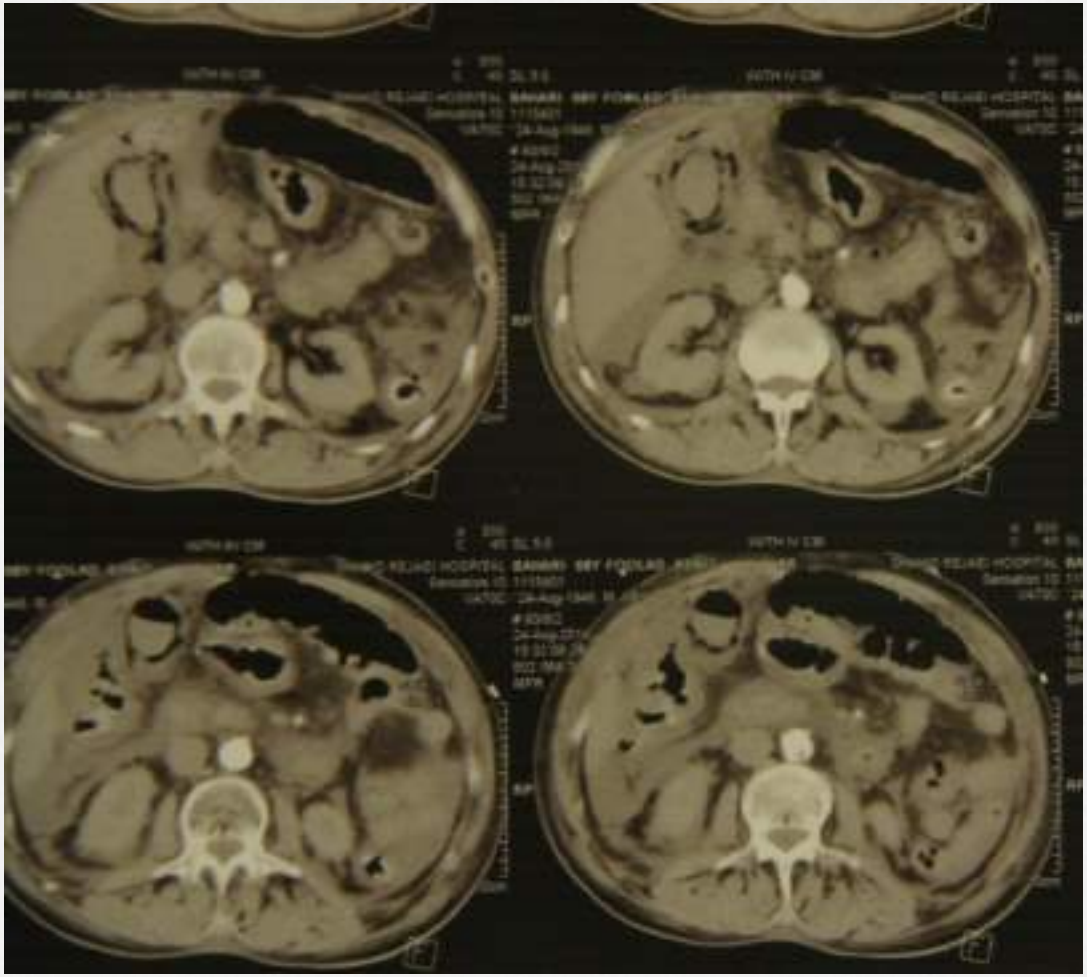
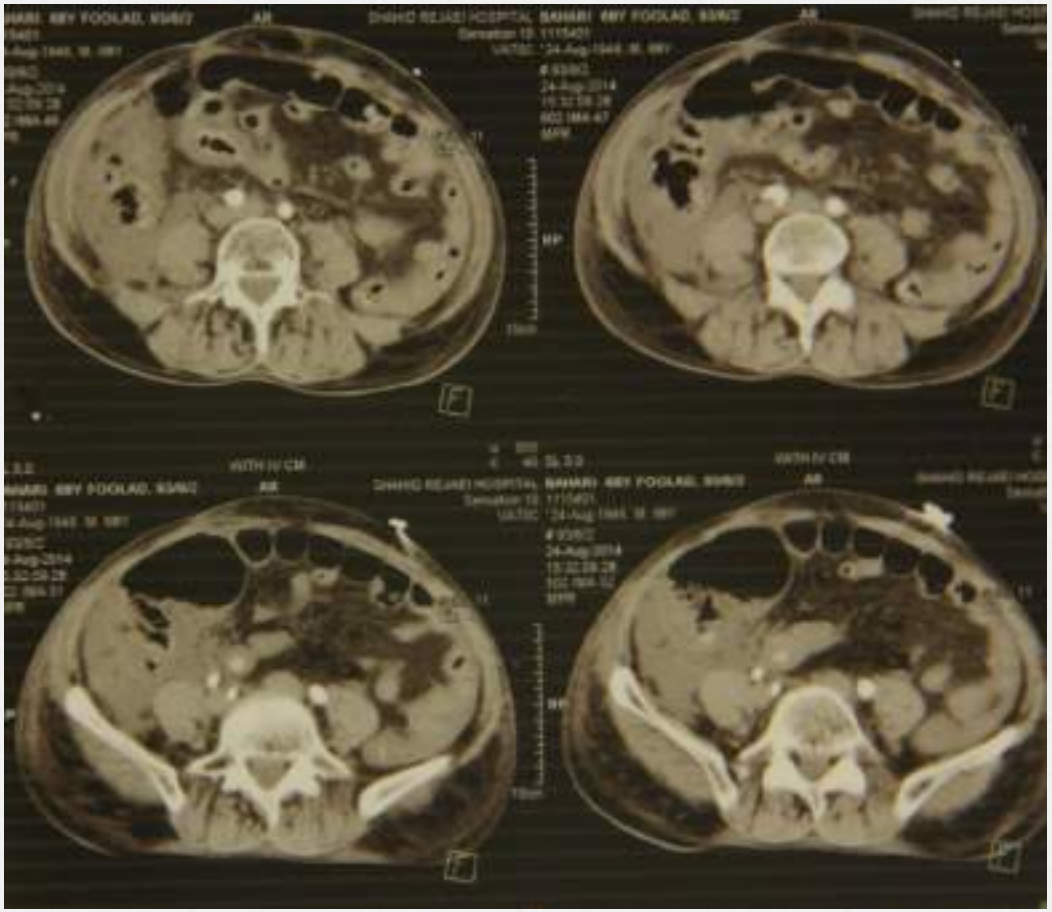
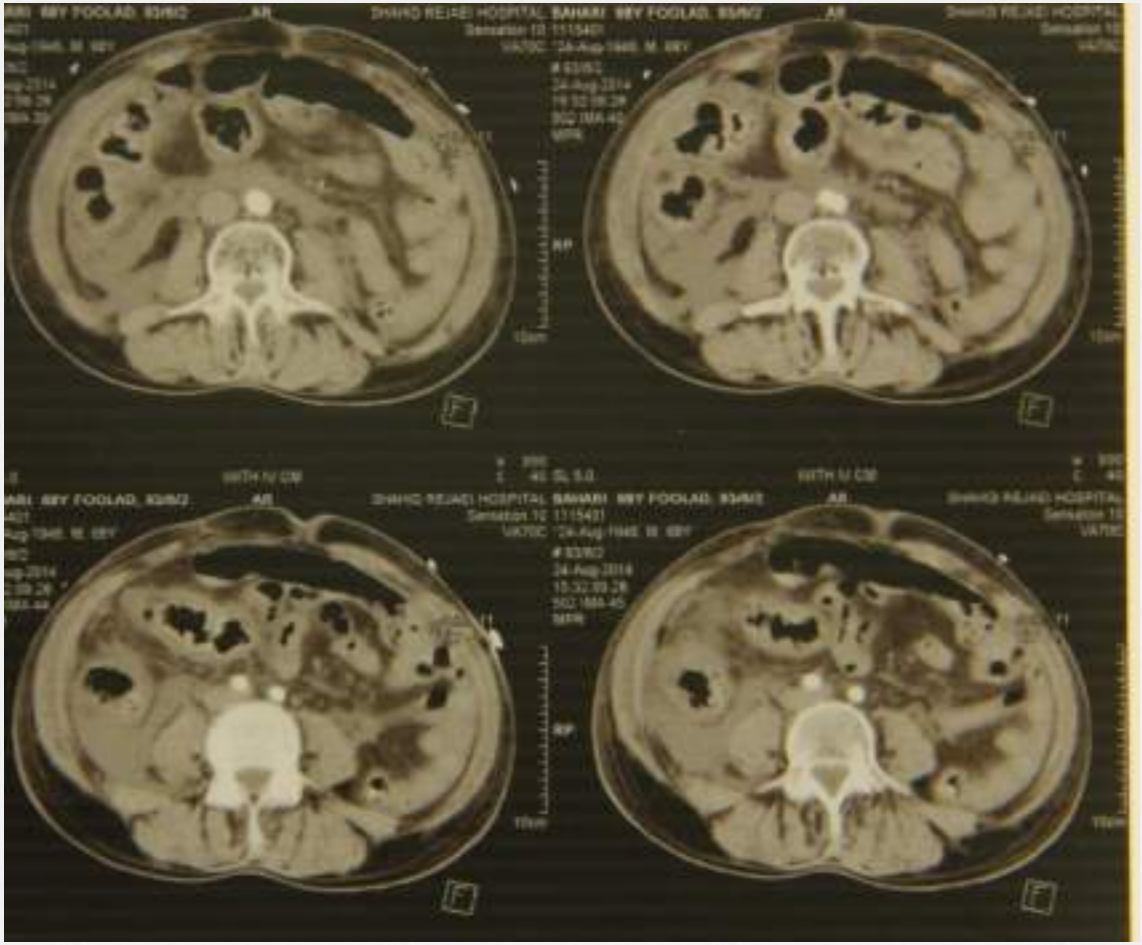
Chest & Abdominal IV contrast CT











Final Diagnosis

Patient's Outcome

Unsafe Acts?!

Nilsson et al. Journal of Cardiothoracic Surgery 2013, 8:156
http://www.cardiothoracicsurgery.org/content/8/1/156

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RESEARCH ARTICLE Open Access

Intestinal ischemia after cardiac surgery: analysis of a large registry

Johan Nilsson[1], Erika Hansson[2] and Bodil Andersson[2*]

Intestinal ischemia after cardiac surgery most often is due to a non-occlusive mesenteric ischemia (NOMI) [13,14]. This condition was first described in 1958, and even though the exact pathophysiological mechanism is not understood, it is related to a reduction in the splanchnic blood flow, which can be due to low cardiac output, and it may also be aggravated by inotropic support such as vasopressors, and by pre-existing atherosclerosis [13]. The ischemia is more seldom a cause of arterial emboli or thrombosis and venous thromboembolism [4].

Incidence of intestinal ischemia

Since intestinal ischemia after cardiac surgery is a rare event, even when large databases are investigated, a limited number of cases are identified. The present study present the lowest described incidence of this complication (0.09%) with a decreasing incidence during the study period from 0.61% ($N = 10$) during the first 5 years to 0.06% ($N = 7$) during the last 11 years.

Table 2 Preoperative univariate risk factors for intestinal ischemia after cardiac surgery

Variable	N	Control group N = 18862	Patients with intestinal ischemia N = 17	p value
Age (years)*	18879	69 (60–75)	69 (59–73)	0.45
Female gender	18879	5187 (27)	6 (35)	0.47
BMI (kg/m^2)*	15066	26 (24–29)	25 (22–27)	0.15
Haemoglobin (g/L)*	15859	135 (123–145)	130 (118–140)	0.56
Creatinine > 200 (μmol/L)	18144	340 (2)	2 (12)	0.04
Dialysis	18652	226 (1)	0	1
Hemodynamic instable	18876	272 (1)	2 (12)	<0.001
Smoking	8518	849 (10)	2 (25)	0.19
Emergency cardiac surgery	18879	1923 (10)	7 (41)	<0.001
Chronic obstructive pulmonary disease	18653	1756 (9)	2 (12)	0.67
Stroke	18653	830 (4)	3 (18)	0.038
Peripheral vascular disease	18653	2388 (13)	7 (41)	<0.001
Left ventricular ejection fraction <30 %	18879	1482 (8)	2 (12)	0.39
Instable angina	18879	1542 (8)	5 (29)	0.01
Cardiogenic shock	16091	282 (2)	3 (23)	0.001
Atrial fibrillation	14786	1552 (11)	2 (14)	0.65
Anticoagulants	18879	2640 (14)	5 (29)	0.078
Steroids	18879	212 (1)	2 (12)	0.016
IABP	18871	576 (3)	2 (12)	0.094
Diabetes mellitus	18652	3462 (19)	3 (18)	1
NYHA 4	18879	2652 (12)	9 (53)	<0.001

Table 3 Per- and postoperative univariate risk factors for intestinal ischemia after cardiac surgery

Variable	N	Control group N = 18862	Patients with intestinal ischemia N = 17	p value
CPB time (minutes)*	18879	92 (71–123)	120 (82–169)	0.026
Creatinine >200 (μmol/L)	16285	598 (4)	10 (59)	<0.001
Dialysis	16361	193 (1)	3 (18)	0.001
Reoperation due to bleeding	18875	942 (5)	3 (18)	0.05
Prolonged ventilator time**	17153	1921 (11)	13 (76)	<0.001
Arrhythmia	14335	4929 (34)	8 (62)	0.074
Atrial fibrillation	16568	4998 (30)	8 (47)	0.18
IABP	16284	282 (2)	4 (24)	<0.001
Initropine >24 h	16284	1039 (6)	10 (59)	<0.001
Cardiac infarction	16284	405 (2)	4 (24)	<0.001
Cerebrovascular insult	16284	173 (1)	4 (24)	<0.001

Table 5 Multivariate risk factors for intestinal ischemia after cardiac surgery

Variable	Odds Ratio (95% confidence interval)	*p* value
Postoperative creatinine > 200 (μmol/L)	17.5 (5.8-53)	<0.001
IABP	3.5 (1.0-12)	0.046
Prolonged ventilator time*	6.2 (1.7-23)	0.006
Cerebrovascular insult	7.8 (2.3-27)	0.001

However, early laparotomies do not necessarily mean survival in cases of extensive ischemia [23]. An alternative to laparotomy would be diagnostic laparoscopy [24]. Angiographically proven NOMI can also be treated with selective intra-arterial bolus injection and subsequent intra-arterial infusion of e.g. tolazoline, papaverine, or prostaglandin E2 [12,20,25]. In a recently published pro-

UW Health

Clinical Practice Guideline (CPG)
Executive Summary

Guideline Title:

Periprocedural Anticoagulation – Adult – Inpatient and Ambulatory – Clinical Practice Guideline

2. Oral Anticoagulation Therapy Considerations For Perioperative Management

2.1. Warfarin

Pre-procedure INR	Warfarin Discontinuation Plan
2.0 – 3.0	Stop warfarin 5 days (hold 4 doses) before surgery or procedure
3.0 – 4.5	Stop warfarin 6 days (hold 5 doses) before surgery or procedure

2.1.1. Check INR within 24 hours of surgery or procedure to ensure that it is less than 1.5 or lower if otherwise indicated ***(Class IIb, Level C)***

2.1.2. Restart warfarin on postoperative day 1 if hemostatsis is achieved and if approved by surgeon ***(Class IIa, Level C)***

2.1.2.1. May start on postoperative day 0 if dose given 12 hours after surgery or procedure and if approved by surgeon ***(Class IIa, Level C)***

3. **Parenteral Anticoagulation for Perioperative Management**
   - 3.1. Consider therapeutic doses for risk of arterial thromboembolism ***(Class IIb, Level C)*** - See table 5
   - 3.2. Therapeutic or prophylactic doses may be considered for venous thrombosis risks ***(Class IIb, Level C)*** - See table 5
   - 3.3. Start a low molecular weight heparin (LMWH) or unfractionated heparin (UFH) when INR < 2.0, usually 48 hours after stopping warfarin. ***(Class IIa, Level C)***
   - 3.4 Prior to procedure
     - 3.4.1 Stop therapeutic LMWH 24 hours before surgery or procedure ***(Class IIa, Level C)***
     - 3.4.2 Stop prophylactic LMWH or SQ UFH 12 hours before surgery or procedure ***(Class IIa, Level C)***
     - 3.4.3 Stop IV therapeutic UFH 4 - 6 hours before surgery or procedure ***(Class IIa, Level C)***
   - 3.5 After procedure
     - 3.5.1 Minor surgery or procedure with low bleeding risk: Start LMWH or UFH 12 to 24 hours if approved by surgeon ***(Class IIa, Level C)***
     - 3.5.2 Major surgery or high bleed risk surgery or procedure: Start LMWH or UFH 48 to 72 hours if approved by surgeon ***(Class IIa, Level C)***
     - 3.5.3 If therapeutic doses of LMWH or UFH were used pre-operatively may consider starting prophylactic dosing in 24 hours ***(Class IIa, Level C)***

4. Antiplatelet Therapy Considerations for Perioperative Management

4.1 Aspirin

4.1.1 Non-cardiac Surgery

Cardiovascular Event Risk	Aspirin Discontinuation Plan
Moderate to High Risk	Continue aspirin around the time of surgery
Low Risk	Stop 7-10 days before surgery

4.1.2 Cardiac surgery (ex. CABG): continue aspirin around the time of surgery ***(Class IIa Level C)***

4.1.3 Restart aspirin 24 hours after surgery or procedure if approved by surgeon ***(Class IIa, LevelC)***

4.2 Thienopyridine Platelet Aggregation Inhibitors: Clopidogrel/ Ticagrelor/ Prasugrel

4.2.1 Patients with a coronary stent on $P2Y_{12}$ therapy who require surgery

Coronary Artery Stent Requiring Surgery	Discontinuation Plan
Bare Metal Stent (BMS)	Defer surgery at least 6 weeks after placement
Drug Eluding Stent (DES)	Defer surgery at least 6 months after placement
BMS or DES unable to defer surgery	Continue antiplatelet therapy around the time of surgery

4.2.2 Patients who require coronary bypass surgery on $P2Y_{12}$ therapy:

Drug	Discontinuation Plan
Clopidogrel	Hold 5 days before surgery
Ticagrelor	Hold 5 days before surgery
Prasugrel	Hold 5 to 7 days before surgery

Evaluate the Risk of Bleeding

Table 1. Bleeding Risk for Surgery/Procedure[2,5,6]

High Risk	Moderate Risk	Low Risk
• Aortic aneurysm repair • Bladder surgery • Bowel polypectomy • Coronary artery bypass grafting (CABG) • Heart valve replacement • Intracranial surgery • Major cancer surgery • Major orthopedic surgery (hip or knee replacement) • Peripheral artery bypass and other major vascular surgery • Prostate surgery • Reconstructive plastic surgery • Spinal surgery/Epidural procedure	• Renal biopsy • Resection of colon polyps • Prostate biopsy • Pacemaker or defibrillator implantation • Major intraabdominal surgery • Major intrathoracic surgery • More invasive dental or ophthalmic procedures	• Cataract surgery • Dental procedures Dental hygiene Simple extractions Restorations Endodontics Prosthetics • Cutaneous surgeries (most) • Laparoscopic cholecystectomy or hernia repair • Coronary angiography • Endoscopy with or without biopsy • Colonoscopy with or without biopsy

Evaluate the Risk of Thrombosis - Identify the indication for anticoagulation and risk of thrombosis if these agents were discontinued

Table 2. Periprocedural Risk for Thromboembolism[2,7]

Risk	High: Anticoagulation advised	Moderate: Anticoagulation considered on a case by case basis	Low: Anticoagulation is generally not advised
Mechanical Heart Valve	• Any mechanical mitral valve • Older mechanical valve model (caged ball or tilting disc) aortic valve • Recently placed mechanical valve (< 3 months) • Recent stroke or TIA (within 6 months)	• Bileaflet aortic valve and 1 of the following: atrial fibrillation, prior stroke or TIA, hypertension, diabetes, heart failure, age >75 years	• Bileaflet aortic valve without atrial fibrillation and no other risk factors for stroke
Atrial Fibrillation *CHADS2 score Table 3	• With mechanical heart valve (any position) • With rheumatic valvular disease • With recent stroke or TIA (within 3 months) • CHADS2* Score of 5 or 6	• CHADS2* Score of 3 or 4	• CHADS2* Score of 0 or 2 (no prior stroke or TIA)
Venous Thromboembolism	• VTE within previous 3 months • With severe thrombophilia (eg. Protein C, S or Antithrombin III deficiency, Antiphospholipid syndrome, Homozygous factor V Leiden mutation)	• VTE 3-12 months ago • Recurrent VTE • With non-severe thrombophilia (eg. heterozygous factor V Leiden mutation, heterozygous factor II mutation) • With active cancer (treated within 6 months or palliative)	• Single VTE > 12 months ago and no other risk factors

***CHADS2 has not been validated for VTE risk in atrial fibrillation. It is used for risk stratification to reduce stroke risk with aspirin vs warfarin.**

Table 4. Anticoagulation Considerations for Endoscopic Procedures[2,4,8]

Endoscopic Procedure	High or Moderate Thromboembolic Risk	Low Thromboembolic Risk
Diagnostic or Screening	Continue warfarin management	Consider holding warfarin and proceeding when INR < 1.5*
Low biopsy risk Removal of < 10 mm polyps with cold snare/forceps	Continue warfarin management	Consider holding warfarin and proceeding when INR < 1.5*
Large polyp removal (> 10 mm)	Hold warfarin and bridge peri-procedural anticoagulation	Hold warfarin and proceed when INR < 1.5*
Sphincterotomy Esophageal Dilation Fine Needle Aspiration	Hold warfarin and bridge peri-procedural anticoagulation	Hold warfarin and proceed when INR < 1.5*

* May consider using peri-procedural anticoagulation