Coronary computed tomographic angiography in combination with coronary artery calcium score for preoperative cardiac evaluation in cancer surgery

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BACKGROUND

- Cardiovascular complications are among the leading causes of morbidity and mortality in patients undergoing non-cardiac surgery.
- Clinical scores and functional tests are the strategy of choice for evaluating these patients, however over one-third of perioperative MACCE occur in patients with a negative study.
- The coronary computed tomographic angiography (CTCA) and coronary calcium score (CAC) are emerging in this context as important predictor of clinical outcomes.

METHODS

- Prospective observational study, single center: ICESP (Cancer Institute of the State of São Paulo)
- **Inclusion criteria**

✓ Cancer patients
✓ Major surgery: thoracic surgeries and open abdominal surgeries
✓ Age above 45 years
✓ No current cardiovascular symptoms
✓ At least 2 of the following
- History of peripheral vascular disease
- Age above 70 years
- History of stroke or TIA
- Current or Former smoker
- History of heart failure
- Dyslipidemia
- Diabetes
- Arterial hypertension
-Sign the informed consent

- **Exclusion criteria**

✓ Allergy to iodinated contrast
✓ Renal insufficiency with creatinine > 2 mg / dL
✓ Previous cardiomyopathy
✓ Presence of symptoms compatible with myocardial ischemia or heart failure
✓ Clinical indication of functional test or invasive coronary angiography
✓ Refusal to participate in the study

Pre operative evaluation
Lipid profile
NT pró BNP
Coronary CT
Electrocardiogram (ECG)

Postoperative evaluation
24h : CKMB , Troponin , ECG
48h: CKMB , Troponin , ECG
After 30 days: evaluation of cardiovascular events

If Coronary CT high-risk coronary artery disease
- stenosis ≥ 50% of the left coronary trunk
- ≥ 70% in three coronary arteries
- ≥ 70% in two arteries, one of them being the anterior descending artery

→ Evaluation by the cardiologist

RESULTS

Figure 1. Flowchart

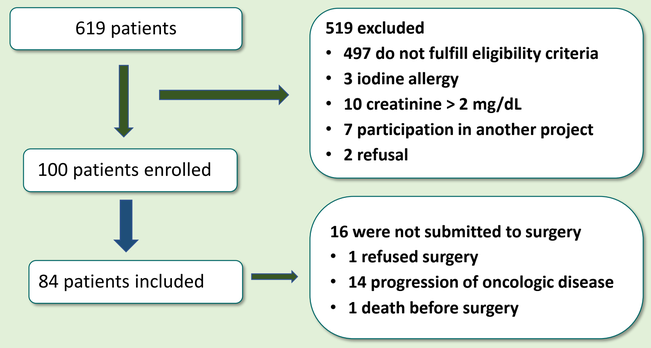


Table 1. Participant baseline characteristics

Characteristics	Myocardial Injury		p
	46 (55%)	38 (45%)	
Age, y	64 ± 10	68 ± 8	0,065
Male sex	26 (56,5%)	22 (57,9%)	0,899
Cancer			
Bladder	3 (7,1%)	5 (15,2%)	
Colon	2 (4,8%)	2 (6,1%)	
Esophageal	1 (2,4%)	15 (45,5%)	
Stomach	2 (4,8%)	0 (0%)	
Pancreas	8 (19%)	0 (0%)	
Prostate	1 (2,4%)	0 (0%)	
Lung	2 (4,8%)	1 (3%)	
Rectal/Sigmoid	23 (54,8%)	9 (27,3%)	
Kidney	0 (0%)	1 (3%)	
T			0,499
T1	5 (11,4%)	2 (5,7%)	
T2	6 (13,6%)	6 (17,1%)	
T3	16 (36,4%)	16 (45,7%)	
T4	12 (27,3%)	5 (14,3%)	
TX	5 (11,4%)	6 (17,1%)	
N			0,387
0	23 (52,3%)	19 (54,3%)	
N1	10 (22,7%)	4 (11,4%)	
N2	4 (9,1%)	3 (8,6%)	
N3	1 (2,3%)	0 (0%)	
NX	6 (13,6%)	9 (25,7%)	
M			
M1	7 (20,6%)	1 (3,6%)	
M0	27 (79,4%)	27 (96,4%)	
Surgery			0,000
Perineal abdomino amputation	13 (28,3%)	2 (5,3%)	
Toracic	2 (4,3%)	1 (2,6%)	
Cistectomy	1 (2,2%)	4 (10,5%)	
Colectomy	1 (2,2%)	0 (0%)	
Duodenumpancreatectomy	4 (8,7%)	0 (0%)	
Esophagectomy	1 (2,2%)	14 (36,8%)	
gastrectomy	3 (6,5%)	0 (0%)	
Others	13 (28,3%)	10 (26,3%)	
Retum/sigmoidectomy	8 (17,4%)	7 (18,4%)	
Anesthesia			0,318
General	8 (19,5%)	10 (29,4%)	
General + epidural	33 (80,5%)	24 (70,6%)	
Vasopressors	8 (19,5%)	18 (48,6%)	0,006
Transfusion	4 (8,7%)	11 (28,9%)	0,016
Red blood cells			0,007
No transfusion	43 (93,5%)	28 (73,7%)	
1	3 (6,5%)	5 (13,2%)	
2	0 (0%)	5 (13,2%)	
NTproBNP	155 (31 - 233)	226 (93 - 437)	0,070
Surgery Duration (min)	260 (165 - 343)	315 (240 - 480)	0,023
Anesthesia duration (min)	366 (300 - 540)	480 (379 - 600)	0,004

Table 2. CTCA findings

Variable	Myocardial Injury		
	No	Yes	p
	46 (55%)	38 (45%)	
Category (CTCA findings)			0,072
normal	17(37%)	9(25,7%)	
non-obstructive	25(54,3%)	15(42,9%)	
uniarterial ≥50%	3(6,5%)	9(25,7%)	
2 or more arteries ≥50%	1(2,2%	2(5,7%)	
Coronary artery calcium - AGATSTON			0,005
<100	36(78,3%)	14(40,0%)	
100-399	7(15,2%)	12(34,3%)	
400-999	2(4,3%)	6(17,1%)	
>1000	1(2,2%)	3(8,6%)	

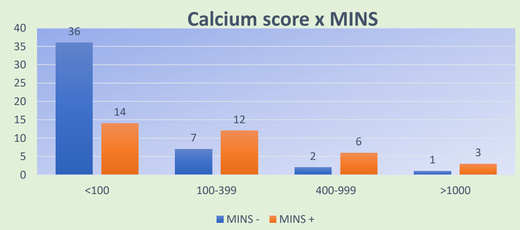
Table 3. Multiple logistic regression for myocardial injury

Variable	Paremeter	Standart error	OR	IC 95%	p
Anesthesia duration (min)	0,007	0,003	1,007	1,001	0,017
Glicemia (mg/dL)	-0,042	0,019	0,959	0,924	0,027
Constant	1,413	2,119			

Table 4. Outcomes

Outomes	n	%
MACCE	6	7,10%
Death (general cause)	5	5,90%
Complex arrhythmias	0	0
Cardiovascular death	1	1,19%
Acute coronary syndrome	0	0,00%
Heart failure	0	0,00%
Sudden death cardiac arrest	0	0
Other outcomes		
Myocardial injury	38	45,20%
Acute renal failures (AKIN)	20	23,80%
Rehospitalization	12	15,30%
Embolic events	3	3,60%
Atrial fibrillation	2	2,40%

Figure 2. Calcium score and MINS



DISCUSSION

- In this study we found that obstructive coronary artery disease uniarterial and two or more arteries were higher in the MINS group
  - Uniarterial: 25.7% vs 6.5%
  - 2 or more : 5.7% vs 2.2%
- Calcium score : CAC < 100
  - 78.3% of patients without MINS vs 40% of patients with MINS
- Calcium score : CAC > 100
  - 60% of patients with MINS vs 21.7% of patients without MINS (P = 0.005)
- We found a MACCE rate of 7.1% in the postoperative period of major oncologic surgeries
- MINS: we found a rate of 45.2%, higher compared to previous studies that showed an incidence of 16.0% in general surgeries
- Multivariate analysis identified as predictive variables :
  - Preoperative glycemia
  - Anesthesia duration
- For an increase in a blood glucose unit the chance of myocardial injury decreases 0.959 times and for every minute of anesthesia duration increases 1.007 times the chance of event

CONCLUSIONS

- The incidence of MINS was higher in the postoperative period of oncologic surgeries when compared to the general surgery data present in the literature
- With the partial analysis of the results, we observed that in the MINS group, esophagectomy surgery was more frequent, increased use of DVA and higher rate of transfusions
- Association of higher calcium score in coronary angiotomography with higher MINS event

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DISCLOSURES

All the authors have no conflicts of interest to disclousure.

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