ECHO IN EMERGENCIES What's new? BLUNT CHEST TRAUMA

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Introduction

- Violent injury: Leading cause of death <40 yo in USA
- Cardiac injury: Majority of deaths in violent injuries
- Motor vehicle accident: The most common etiology of blunt cardiac injury. Almost 10-fold increase between 1950-1990
- Among pts with blunt chest trauma: Autopsy studies showed 15-20% cardiac, 15-17% great arteries involvement (*Rene Petre, NEJM 1997;336:626-32*)

Classification of Blunt Cardiovascular Trauma

Pericardium

- 1. Hemopericardium, pericardial haematoma
- 2. Rupture or laceration
- 3. Constrictive or serofibrous pericarditis
- Myocardium
- 1. Contusion
- 2. Free wall rupture
- 3. Septal rupture
- 4. Aneurysm or pseudoaneurysm
- 5. Laceration

Valve injury

- 1. Rupture of leaflets, chordae
- 2. Pap. Muscle contusion Coronary artery injury (MI)
- 1. Thrombosis
- 2. Arteriovenous fistula
- 3. Laceration

Great vessel injury

- 1. Rupture
- 2. Aneurysm formation
- 3. Aorta-cardiac chamber fistula
- 4. Thrombotic occlusion Commotio Cordis



Rene Petre, NEJM 1997;336:626-32

Cardiac injury caused by blunt chest trauma

	Autopsy	Clinical series
Valve rupture	5%	?
Coronary artery rupture	2%	?
Chamber rupture	36-65%	0.3-0.9%
RA	10-15%	36-65%
RV	19-32%	17-32%
LA	1-7%	20-31%
LV	17-44%	11-15%
Two or more chambers	23-32%	6-10%

Rene Petre, NEJM 1997;336:626-32

Injury to the great arteries caused by blunt chest trauma

	Autopsy	Clinical series
Ascending aorta and arch	8-23%	0-10%
Aortic isthmus	70-86%	80-90%
Aorta at the aortic hiatus	0-14%	0-5%
More than one site including	2-20%	5-10%
aortic arch arteries		

Diagnosis

- Absence of chest wound does not r/o cardiac injury (acceleration trauma)
- No characteristic symptoms
- Complex arrythmias, thrill, murmur
- Compromised haemodynamics
- Persistent angina like chest pain, days or months after blunt chest injury
- Elevated cardiac enzymes (laceration may be associated with normal values)

Orientation flow chart for pts with suspected blunt cardiac trauma



Electrocardiographic findings in cardiac contusion

Pericarditis-like ST segment elevation. Prolonged QT interval

Myocardial injury

- New Q wave
- ST-T segment elevation or depression

Conduction disorders

- RBBB
- Fascicular block
- AV nodal conduction disorders
- Sinus tachycardia, bradycardia
- APC, VPC
- AF, Atrial tachycardia
- VT, VF

Echocardiographic findings in acute cardiac contusion

TTE or TEE

- Regional wall motion abnormalities
- Pericardial effusion
- Valvular lesions
- Right and left ventricular enlargement
- Ventricular septum rupture
- Intracardiac thrombus

TEE

- Aortic endothelial laceration or aortic dissection
- Aortic rupture

Table 2 Findings on transthoracic and transoesophageal echocardiography in 134 patients suffering from blunt chest trauma

- · · · · · · · · · · · · · · · · · · ·	TTE, n (%)	TOE, n (%)
Feasibility	51 (38)	131 (98)
Aortic rupture	3 (6)	14 (10.5)
Mvocardial contusion	15 (21.5)	45 (34) 🔙
Valvar lesions	0	2 (1.5)
Periaortic haematoma	5 (10)	34 (26)
Pericardial effusion	28 (55)	40 (30.5)
Left pleural effusion	35 (69)	51 (39)

TTE, transthoracic echocardiography; TOE, transoesophageal echocardiography.

All RWMA due to myocardial contusion normalized on repeat echo. TEE method of choice to shorten the time from admission to diagnosis and surgery *Chirillo et al. Heart 1996;75:301-306*

RWMA post blunt chest trauma

Myocardial contusion

- RWMA distribution not specific for coronary artery territory
- Resolution within weeks
- Permanent akinesia, aneurysm, pseudoanerysm or rupture: rare

Coronary artery rupture, dissection or thrombosis (2%)

- RWMA distribution **specific** for coronary artery territory
- Permanent akinesia, aneurysm, pseudoanerysm or rupture



Prof football player 26 yo, precordial kick 5 years ago, normal coronaries, possible healed dissection LAD, HF, AICD, autologous stem cell tranfusion,TX list.

TEE findings

Myocardial Abnormal regional wall motion	n	%
Right ventricular wall hypokinesis	28	24
Anterior-septal hypokinesis/akinesis	13	11
Inferior-posterior hypokinesis	4	3
Right ventricle dilation	15	13
Interventricular septum rupture	1	1
Pericardial		
Pericardial effusion	13	11
Cardiac tamponade (hemopericardium)	1	1
Valvular		
Mitral valve rupture		
Leaflet disruption	1	1
Chordal rupture	1	1
Tricuspid valve prolapse*	1	1
Aorta		
Aortic rupture [†]	8	7
Aortic dissection	1	1
Normal/no related findings	51	44

ECG: sens 59%, spec 73% MB: sens 64%, spec 52%

*Associated with moderate-severe tricuspid regurgitation and right ventricular wall hypokinesis.

[†]Aortic wall tear at the level of isthmus (seven patients) or ascending aorta (one patient). No pseudoaneurysms were found.

Spanish multicenter study including 117 pts with blunt chest trauma Pts with cardiac involvement proved by TEE had higher CK-MB, and more frequent ECG abnormalities but no distinction could be based on ECG and CK-MB.

Cardiac contusion in blunt chest trauma: significance of troponin I

- Elevated TnI can be found in more than half of patients with blunt chest trauma
- Segmental wall motion in 6/10 patients with TnI > 1 ng/ml (60%), but in no patient with normal or 0.4-1 ng/ml.
- Myocardial injury was detected by TEE only if TnI > 1 ng/ml
- Relatively small study group (17pts)

Mori et al. Ital Heart J 2001; 2(3): 222-7

Comparison of TEE and spiral CT diagnostic value for arterial injuries in blunt chest trauma

	Sensitivity (%)	Specificity (%)	NPV (%)	PPV (%)
EE	93	100	99	100
piral CT	73	100	95	100

Vignon et al. Anesthesiology 2001;94:615-22



"Clinical suspicion": type and severity of injury, ECG, TTE, cardiac enzymes

Vignon et al. Anesthesiology 2001;94:615-22





37 yo female, front seat no belt, myocardial contusion, Atr. Sept and TV rupture Severe cerebral injury



42 yo female, vehicle-pedestrian accident, RV laceration, hemopericardium, LV contusion



62 2:53 HR

CONCLUSION

- Blunt chest trauma is a major cause of mortality and morbidity in young population
- Injury of the heart and aorta must be ruled out in pts with blunt chest trauma especially when hemodynamically unstable
- Chronic consequences of BCT may include unexplained RWMA or valvular lesions in young pts with history of chest injury
- TEE and spiral CT are important diagnostic tools
- TEE is the method of choice in pts with compromised hemodynamics

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