49 y/o male with crushing chest pain is enroute to your facility via ambulance

Time Is Muscle
Door to PCI time = 49 minutes
Ambulance EKG to PCI time = 66 minutes

- Occluded RCA
- RCA post stent
Case Study # 2
CHB-MJ

Admitted to ED persistent abdominal pain

- Persistent pain bilaterally in lower abdominal quadrants and lumbar area
- Hydrocodone used for past three weeks for pain which has improved the pain.

Admission EKG
What’s the rhythm?

1. Sinus Rhythm
2. Sinus Bradycardia
3. Sinus Bradycardia with 3rd AV Block
4. Wenckebach

- Severe Left Atrial Enlargement
- Notched P wave > 0.12 second in limb leads
- Produces a double hump (camel hump)

What is the rhythm?

A. Sinus Rhythm with blocked PAC
B. Wenckebach (Mobitz I)
C. Classical Heart Block Mobitz Type II
D. Complete Heart Block
E. AV Dissociation
F. Other

- Right Atrial Enlargement
- Peaked P wave taller than 2.5 mm in the limb leads
- P pulmonale = teepee
Advanced High Grade Second Degree AV Block

Review of blocks
- First Degree AV Block: PR interval > 120 msec
- Wenckebach: PR gets longer, longer, until drops
- Classical Mobitz Type II: PR constant. Drop QRS
- Complete Heart Block (Third Degree): no correlation between p waves & QRS

Never Forget & Mix Up Blocks Again
- https://www.youtube.com/watch?v=FgyGbIw1rKA
- You tube...

Cardiology Consult
- Transfer to cardiac unit with external pacemaker readily available
- Echo normal LVEF, no valvular disease
- Etiology of AV block unclear
  - Electrolytes normal, QT not prolonged
  - Lupus can lead to conduction disease
  - Typically complete heart block and prolonged QT
  - Secondary to pain medications and sedatives
  - Limit narcotic pain meds & sedatives
  - Hypothyroidism as culprit
  - Lyme Carditis – check Lyme titer
**Lyme Carditis**

Occurrence 1% of Lyme Disease patients

- Occurs when Lyme disease bacteria affects the tissues of the heart – interferes with cardiac conduction
- Cardinal clinical manifestation is self limited conduction disease at the level of the AV node
  - May progress from prolonged PR (First Degree) to complete heart block within minutes
  - Temporary pacing needed in about 30% of Lyme Carditis
  - Rarely permanent pacing needed
  - Complete heart block generally resolves within one week
  - Lesser arrhythmias resolve within 6 weeks
- Oral antibiotics, if mild; IV antibiotics, if severe
- Most recover completely within 1-6 weeks

**Negative Lyme Titers for case study**

**Pacemaker??**

External/Transcutaneous

- **YES**

Permanent

- Possibly – if AV block does not resolve

Rhythm changed to First Degree AV block after minimizing narcotics

No pacer needed

**What Is a Toxidrome?**

- Constellation of signs and symptoms usually observed after exposure to a toxic substance
- Physiologically grouped abnormalities
  - Vital signs
  - Skin and mucous membranes
  - Pupils
  - Cardiovascular system
  - GI and GU system
  - Neurologic findings/mental status

**Major Findings**

- CNS depression
- Respiratory depression
- Miosis (small pupils)

**Examples**

- Heroin
- Morphine
- Fentanyl derivatives (China White)

**Possible Specific Therapy**

- Naloxone
- Supportive care

**What Is the Toxidrome?**

- Now admits taking hydrocodone more than prescribed to alleviate her symptoms
Medical Marijuana – Cardiologist

- Don’t think it is safe to pursue medical marijuana as it may further slow her heart rate
- In addition, she has the propensity of mixing it with narcotic medication which could lead to serious cardiovascular complications

Discharge Instructions

- Daily aerobic activity at least 15 minutes per day with stretching exercises at least 15 minutes or more.
- Deep breathing techniques
- 8 or more hours of quality sleep nightly
- Pain clinic consult
- 10 Steps from Patient to Person: American Chronic Pain Association
- 12 Steps of Recovery to counteract unhealthy attachments to opiates and other potentially problematic coping mechanisms

Cannabis (Marijuana) Intoxication

- Lethargy & Coma following cannabis ingestion does not respond to naloxone
  - Thus can differentiate from opioid toxicity
- Overlapping clinical features of intoxication with:
  - Cocaine
  - Amphetamines & bath salts
  - LSD, PCP
  - Ecstasy
- Duration of intoxication typically shorter than for other recreational drugs
  - If prolonged symptoms, check for other intoxicants
- Can cause tachycardias or bradycardias – biphasic effect on the autonomic nervous system
  - Low/Moderate doses → ↑ SNS & ↓ parasympathetic activity.
  - Tachycardias – Atrial, SVT, hypertension
  - High doses → SNS inhibited & ↑ parasympathetic activity
  - Bradycardia, AV block, hypertension

Two Months follow up

- Functional Stress Test → able to reach target HR 168 bpm without any significant issues
- No chronotropic incompetence was found
- 12 Lead EKG Sinus Rhythm rate 72 with early repolarization
- Echo EF = 55%
- No further follow up needed with cardiology.

Case Study # 3

Admit to ED for chest pain

- Pressure in the midsternal area with radiating to the right arm. Feels like someone pushing on chest
Admission EKG

ST Elevation – consider inferior injury marked
ST elevation without normally inflected T wave (II, AVF)

Nitrates
Isorobide (Imdur)

- Produce a direct, endothelium-independent vasodilatation of the large coronary arteries.
- Reduce preload by dilating venous capacitance vessels, which results in decreased myocardial oxygen consumption.
- Act as an exogenous source of nitric oxide, which causes vascular smooth muscle
- Nitrates and calcium channel blockers are the mainstays of medical therapy for vasospastic angina

Calcium Channel Blockers

- Relax coronary smooth muscle and produce coronary vasodilation, which in turn improves myocardial oxygen delivery

Mega Monster Energy Drink

Caffeine Levels

240mg
per 24 fl. oz can

240 mg of caffeine

7 times the amount of caffeine as 12 oz can Coca Cola!

How does Mega Monster Energy Drink compare?

- Monster Energy Drink,
  - 24-ounce can
  - 240 mg of caffeine
- Coca-Cola Classic
  - 12-ounce can
  - 34 mg of caffeine

Source: http://www.caffeineinformer.com/caffeine-content/mega-monster-energy-drink
ED visits involving energy drinks doubled from 2007 to 2011

Large amounts of caffeine can cause adverse effects such as:
- Insomnia
- Nervousness
- Headache
- Tachyarrhythmias
- Seizures
- That are severe enough to require emergency care


Caffeine

- Is a diuretic and causes a loss of fluid
- Then add cardiovascular workout and sweating
- Lose electrolytes also
- Leads to arrhythmias

What Is the Toxidrome?

Major Findings
- Tachycardia
- Arrhythmias
- Agitation
- Diaphoresis
- Mydriasis (large pupils)
- Hypertension
- Hyperthermia

Examples
- Amphetamine
- Cocaine
- Ephedrine
- Bitter orange

Possible Specific Therapy
- Benzodiazepines
- Cooling

Cocaine Induced Chest Pain/AMI

- 56 – 85 % abnormal EKG
- Early repolarization patterns (32%)
- Left ventricular hypertrophy pattern (16%)
- Typically ST segment Elevation MI (2%)
- Acute ischemia changes (6%)


ST Elevation Patterns

- ST segment elevation for STEMI
- Early Repolarization ST Elevation
Elevated take-off of ST segment at the J point
- Concave upward ST elevation ending with a symmetrical upright T wave, often of large amplitude
- Gently upsloping and curving downward or sagging of the ST segment, producing the so-called “smiley face”
- Contrasted with the junctional elevation and horizontal or straight ST segment & the curving upward of “sad face” of the STEMI examples
- No reciprocal ST segment depression

Cocaine induced chest pain
- RCA
- LAD & CX

Cocaine induced AMI Therapeutic Strategies
Treat as ACS except...
- Avoid β-blockers acutely due to the unopposed α-adrenergic effect, which may lead to:
  - worsening coronary vasoconstriction
  - increased blood pressure
  - risk of exacerbating coronary spasm. (Class III, C)
- IV NTG, Nitroprusside for persistent hypertension (phentolamine – alternative).

Cocaine induced AMI Therapeutic Strategies
Treat as ACS except...
- IV Benzodiazepines to relieve chest pain & lead to beneficial effects on cardiac hemodynamics. Also relieves anxiety. (Class I, B)
- Calcium channel blockers should not be used as first-line therapy but may be considered in patients not responsive to benzodiazepines or NTG. (Class III, C)
- Phentolamine decreases coronary vascular resistance and blood pressure after cocaine ingestion, and may be considered in patients not responsive to NTG or calcium channel blockers. (Class III, C)

Therapeutic Strategies
Treat as ACS except...
- In patients with chest pain of unclear origin, hypertension & tachycardia should be treated conservatively.
- Cautious use of fibrinolytic therapy for STEMI higher rate of cranial hemorrhage with cocaine use.
Case Study # 4

Admit to ED due to SOB and abdominal/back swelling

- Two days ago noticed abdomen and back were swollen. It was difficult to feel his spine as there was so much fluid

12 Lead EKG 101
Learn the Normal so you can detect the abnormal

Hypertrophy

- Complexes larger because takes longer to get through atria or ventricle
- Atrial enlargement = Large p waves
- Ventricular enlargement = Tall R waves

ECG 11-5 Left Ventricular Hypertrophy

- S in V1 or V2 + R in V5 or V6 ≥ 35 mm
- Any precordial lead is ≥ 45 mm
- The R wave in AVL is ≥ 11 mm
- The R wave in Lead I is ≥ 12 mm
- The R wave in lead AVF is ≥ 20 mm
S in V1 or V2 + R in V5 or V6 ≥ 35 mm.

Or

Any precordial lead is ≥ 45 mm
The R wave in AVL is ≥ 11 mm
The R wave in Lead I is ≥ 12 mm
The R wave in lead AVF is ≥ 20 mm

Remember V1 and V2 should be mostly negative.

• R:S ratio is ≥ 1 in leads V1 and/or V2
• R is bigger than S

Back to 25 y/o Case Study.... Possible LVH

32 y/o male

• Jan 16 – playing basketball & got hit in chest
1-19- 1335 Clinic

What type of bundle branch block is it?
1. Left
2. Right

1-22 ED
Anteroseptal infarct – sent urgently to cath lab

What should be done?

Case Study pt with RBBB

LBBB Example

1. Send to ED
2. Get Echocardiogram
3. Cardiology consult as outpatient

LifeVest

- The LifeVest is worn outside the body rather than implanted in the chest.
- This device continuously monitors the patient’s heart with dry, non-adhesive sensing electrodes to detect life-threatening abnormal heart rhythms.
- If a life-threatening rhythm is detected, the device alerts the patient prior to delivering a treatment shock, and thus allows a conscious patient to delay the treatment shock.
- If the patient becomes unconscious, the device releases a Blue™ gel over the therapy electrodes and delivers an electrical shock to restore normal rhythm.

SmitCo Personal Defibrillator

https://www.youtube.com/watch?v=TwP55Irg8Z8

The LifeVest is worn outside the body rather than implanted in the chest.

LifeVest

https://lifevest.zoll.com
1 1/2 hours after ED arrival,

- 30 sec V Tach, unresponsive,
- Vest shocked within 27 seconds
- Pt woke up

Case Study # 6

Note S1, Q6
And S waves in V3 and V4
Axis = -36 LAD
**Pulmonary Embolus**

- S1, Q3 or S1, Q3, T3 (inverted T)
- RBBB
- Inverted T waves secondary to RV strain may be seen in the right precordial leads and can last for months

**Misc Pulmonary EKGs**

**Normal QRS complex – The Q wave**

- Q wave is the first negative deflection after the p wave
- Always first may or may not be there.
- Comes first in the alphabet
- There are normal and abnormal Q waves

**Normal QRS complex – The R wave**

- R wave is the first positive deflection after the p wave
- Always Rising above

**Normal QRS complex – The S wave**

- S wave is the second negative deflection after the R wave
- Slipping down
- Always after R wave like in the alphabet

**In Memory**

Arthur Greenbank, RN, BSN

s/o SOB??
ASK if traveled anywhere recently!
Review of Normal QRS complex

▪ Q wave is the first negative deflection after the p wave
▪ R wave is the first positive deflection after the p wave
▪ S wave is the second negative deflection after the R wave

12 Lead EKG 101
Learn the Normal so you can detect the abnormal

Pulmonary Disease Pattern
Noted by poor R Waves and deep S waves in V leads.

Pulmonary Hypertension

▪ P - Pulmonale (RAE) --- Tall P waves
▪ Right axis deviation – Lead I negative, AVF Positive
▪ Increased R/S ratio in V1 to V2
▪ RVH strain pattern
▪ S1, Q3, T3 pattern

Right Ventricular Strain Pattern

▪ Increased R:S ratio (RVH)
▪ Concave downward ST segment that is depressed
▪ Flipped symmetrical T wave
Warning signs – won’t do well in surgery

- RBBB and RVH → think pulmonary hypertension
- Peaked p waves → think atrial enlargement
- Inverted t waves → think right ventricular strain

Wellens’ Syndrome

- Characterized by symmetrical, often deep (>2 mm), T wave inversions in the anterior precordial leads.
- Warning of critical stenosis of LAD

Case Study # 7

SP

Admit to ED with SOB and left sided chest pain for the past hour

What is Antiphospholipid syndrome?

- An autoimmune disease
- “Antiphospholipid antibodies” react against proteins that bind to anionic phospholipids on plasma membranes.
- The exact cause is not known, but activation of the system of coagulation is evident.
- Clinically important: antiphospholipid antibodies are associated with thrombosis and vascular disease.

EKG 12-2 at 2200 in ED

What diagnosis might you be thinking?

1. NSTEMI
2. Pulmonary Embolus
3. COPD exacerbation
4. Pleurisy
5. Right Ventricular strain
6. Other
What diagnosis might you be thinking?

- Right ventricular hypertrophy
- RV strain pattern
- Nonspecific ST abnormalities

What do you see?

- 1. Normal
- 2. Hypertrophy
- 3. Pneumonia
- 4. Pneumothorax

CXR 12-2 in ED

- No lung markings
- With large pneumothorax, side of chest with pneumothorax will be larger and blacker

Back to Case Study

**DX:** Spontaneous pneumothorax on 12 – 2

CT scan view post chest tube insertion

- BP 101/65
- HR 113, regular
- RR 20
- SpO₂ 100% on 15 liters nonrebreather
- Pain 2/10

CXR 9 hours post chest tube insertion at 0800

Is the pneumothorax resolved?

Pt is admitted to progressive care – what assessments would you do during your shift?
CXR on 12 – 3 at 1215 after 2nd chest tube inserted

- Patient did not go to surgery for decortication due to pulmonary hypertension – poor surgical candidate
- Sent home with Heimlich valve

Heimlich Valve

- One way valve
- Can be discharged
- Call 911 if sudden sharp chest pain and severe shortness of breathe

Classifications of air leak syndromes CCRN, CSC, CMC test plan

1. Primary pneumothorax
2. Secondary pneumothorax
3. Iatrogenic pneumothorax
4. Pneumomediastinum
5. Pneumopericardium
6. Hydropneumothorax

Pneumothorax Clinical Presentation

- Diminished or absent lung sounds over the affected lung
- Dyspnea
- Tachypnea
- Acute pain on affected side of the chest
- Decreased SpO₂ & pO₂
- Subcutaneous emphysema
- Black area over lung field with no lung markings on CXR
Pneumothorax

- Initial Treatment:
  - Chest tube insertion if greater than 10 – 15%
  - If tension pneumothorax — it is a medical *EMERGENCY* and needs immediate needle decompression

Primary Spontaneous Pneumothorax (PSP)

- Occurs without a precipitating event in a person who does not have lung disease
- Most individuals with PSP have unrecognized lung disease

Secondary Spontaneous Pneumothorax (SSP)

- A pneumothorax that occurs as a complication of an underlying lung disease
- Can be a complication of any lung disease. Most often occurs with:
  - COPD
  - Pneumocystis jirovecii infection
  - Cystic fibrosis
  - Tuberculosis

SSP Clinical Presentation

- C/O of dyspnea and chest pain on the same side as the pneumothorax
- Symptoms more severe than with PSP as SSP patients have less pulmonary reserve due to the underlying lung disease.
- Persistent air leaks are more common and tend to persist longer than PSP

SSP Treatment

- Should be hospitalized: diminished pulmonary reserve increases their risk for adverse outcomes.
- Initial Treatment
  - Chest tube insertion
  - Chest tube should remain in place until a procedure if performed to prevent recurrent SSP
SSP: Prevention of recurrence

- Video-Assisted Thoracoscopy (VAT) with stapling of blebs and pleural abrasion.
- Chemical pleurodesis
- Pleural Blood Patch
- Heimlich valve

Nursing Care of Chest Tubes

- Bubbling in the water seal chamber indicates air leak
- If suction is ordered for PSP or SSP, keep suction going even when ambulating!

PSP and SSP – high risk activities

- Patients with resolving pneumothorax should be cautioned not to fly until intrapleural air has completely resolved.
- Deep sea diving should be avoided unless thoracotomy or pleurodesis has been performed

I’m not a Cardiac Nurse!

- Biventricular Pacemaker is used in Stage 4 Heart Failure with Left Bundle Branch Block
  - Three Leads: Third lead paces the left ventricle to provide ventricular synchrony
- During procedure a central line is inserted via the right internal jugular vein and the pacemaker leads via the left subclavian
- Key point — two insertion sites!

Routine Procedures?!?!?

- What are potential complications from central line and/or pacemaker insertion?
- What Diagnostics should occur post procedure?
### Potential Post Procedure Complications

**Central Line & Pacemaker Insertion**

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<th>Delayed</th>
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<tbody>
<tr>
<td>• Bleeding</td>
<td>• Infection</td>
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<tr>
<td>• Arterial puncture</td>
<td>• Venous thrombosis/Pulmonary embolus</td>
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<tr>
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<td>• Catheter migration</td>
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<tr>
<td>• Air Embolism</td>
<td>• Catheter embolization</td>
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<tr>
<td>• Pneumothorax</td>
<td>• Myocardial perforation</td>
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<tr>
<td>• Hemothorax</td>
<td>• Nerve injury</td>
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<td>▪ Venous thrombosis/Pulmonary embolus</td>
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<td>▪ Myocardial perforation</td>
<td>▪ Nerve injury</td>
</tr>
<tr>
<td>▪ Pneumothorax</td>
<td></td>
</tr>
</tbody>
</table>

### What do you see?

1. Normal
2. Lead dislodgement
3. Hypertrophy
4. Pneumothorax

### What actions do you need to do to insert a chest tube?

- Call Rapid Response Team – RRT
- Get chest tube insertion cart

### Chest Tube inserted

- Significant pneumothorax on right with tension pneumothorax component
- Note shift of heart to left

### Pneumothorax resolved

- Patient now in no distress
- Respirations easy and regular
- Another chest x-ray ordered

- Note lung re-expanded
Iatrogenic pneumothorax

- Medical procedure resulting in traumatic pneumothorax
- Transthoracic needle aspiration procedures
- Subclavian and supraclavicular needle sticks
- Thoracentesis
- Mechanical ventilation related to peak airway pressures
- Pleural biopsy
- Transbronchial lung biopsy
- CPR
- Tracheostomy

Iatrogenic & Traumatic Pneumothorax Treatment

- Needle Aspiration
- Chest Tube insertion
- Recurrence is not usually a factor

Case Study # 9

Admit to ED with chest pain

- Chest discomfort that radiated up into her neck and jaw.

Prolonged QT
What do you think?
1. Pneumothorax
2. Pulmonary Embolism
3. Cardiomyopathy
4. Thoracic Aneurysm

Normal Size of Aorta

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<tbody>
<tr>
<td>Root</td>
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<tr>
<td>Ascending</td>
<td>2.86</td>
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<tr>
<td>Mid Descending</td>
<td>2.39–2.64</td>
</tr>
<tr>
<td>Diaphragmatic</td>
<td>2.43–2.69</td>
</tr>
</tbody>
</table>


A Silent Disease

- 40% of individuals are asymptomatic at the time of diagnosis
  - Often discovered on a routine CXR or abdominal sonogram
- Only 5% of patients are symptomatic before an acute aortic event.
  - The other 95%, the first symptom is often death

Aortic Aneurysm (AA)

Thoracic TAA

Abdominal AAA

AA Dissection Symptoms
“The Great Imitator”

- S/S depend where the dissection occurs and what area is not getting oxygen
- Confused with:
  - Kidney stones
  - Gallstones
  - Paralysis – think neuro diagnosis
  - Myocardial infarction
AA Symptoms

- Abrupt onset of excruciating pain in chest, back, or abdomen
  - Ascending Dissection
  - Retrosternal pain that is not exertional in nature
  - Descending Dissection
  - Intercapsular chest pain
  - Severe flank pain
  - Epigastric pain
- Ripping, tearing, stabbing and or sharp quality of pain

Aortic Dissection Classification: DeBakey and Stanford Classifications


Endorsed by the North American Society for Cardiovascular Imaging.
**Acute AoD Management Pathway**

**STEP 2: Initial management of aortic wall stress**

**Intravenous rate and pressure control**

1. No Hypotension or shock state?
   - Yes
   - No

**Rate/Pressure Control**

- Intravenous beta blockade or Labetalol
  - If contraindication to beta blockade, substitute diltiazem or verapamil
  - Titrate to heart rate ≤ 60

**Pain Control**

- Intravenous opiates
  - Titrate to pain control

**Hypotension or shock state?**

- No
  - Systolic BP > 120 mm Hg?
    - Yes
    - BP Control
      - Intravenous vasodilator
        - Titrate to BP < 120 mm Hg
        - Goal is lowest possible BP that maintains adequate end organ perfusion
    - Secondary pressure control
  - Yes
    - Urgent surgical consultation

**Anatomic based management**

1. Type A dissection
   - Urgent surgical consultation
   - Arrive for expedited operative management
   - Intravenous fluid bolus
     - Titrate to MAP of 70 mm Hg or Euvolemia
     - If still hypotensive begin intravenous vasopressor agents
   - Evaluate etiology of hypotension
     - Review imaging study for evidence of contained rupture
     - Consider TTE to evaluate cardiac function
   - Urgent surgical consultation

2. Type B dissection
   - Review imaging study for:
     - Percutaneous tamponade
     - Contained rupture
     - Severe aortic insufficiency
   - Urgent surgical consultation

---

**Case Study #10**

LAST BUT NOT LEAST....

AZL

**Admission**

21:22

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</tr>
<tr>
<td>Potassium</td>
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Based on ABGs and CXR, what do you want to do?
Clear bilateral lung sounds except diminished right upper lobe

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CXR at 0530 after ET tube pulled back 2 cm suctioned with mucomyst for tan secretions.

Azygos Lobe

- Right upper lobe bronchus comes off trachea versus right main bronchus
- A rare congenital variation of the upper lobe of the right lung
- An anatomically separated part of the upper right lobe
- Not associated with any morbidity but can cause technical problems in thoracoscopic procedures

ALL chest pain is cardiac until proven otherwise

- Ask Questions to get a good history!
  - Was the chest pain stabbing, knife like?
  - SOB – have you traveled anywhere?
- Call for decreasing oxygen saturations and increasing oxygen needs
- Look for the obvious!