Body imaging rotation
‘Nuggets’ for the neophyte
Protocoling CT scans

1\textsuperscript{st} week of rotation:

Have an attending review ALL protocols

2\textsuperscript{nd} week of rotation:

Have an attending or senior resident review ALL protocols

3\textsuperscript{rd} week of rotation until eternity:

Have an attending/resident review ALL protocols you have any uncertainty about.

**If you plan to deviate from what was \textit{ordered} on the req, you MUST run it by an attending (may also require a phone call to the ordering doc) (ie body part, contrast, protocol)**
**Do the protocols twice daily**

7:45am – so that you complete them in a reasonable time frame to allow you to interpret several CTs in the morning.

3:30pm – don’t forget to make this afternoon sweep to capture studies that will be done in the evening or early the next day
What

• All a/p (including EVAR, TEVAR CTAs)
• Chest too, if part of a/p
  – If stand alone chest, let chest protocol
• Chest to protocol the following
  – All stand alone chests, regardless of indication
  – TAVR (not EVAR, TEVAR)
  – All cardiac
  – Pulmonary vein ablation
How?

- Protocol box on the green sheet attached to req
- All body protocols are listed
- Circle the one you are prescribing
- Circle the oral prep you are prescribing (if none, choose none)

Think of the protocols as a prescription; don’t choose one without knowing patient’s pertinent history and the true indication for the study. Don’t choose one if you have uncertainty; ask for help.
Things to consider

- Age of patient
- # of prior CT scans. Is there an alternative test?
- Is this scan necessary, will it change clinical management?
What do you need to know to choose the correct protocol...........

1. When the target organ enhances maximally

2. Does the tumor/abnormality you are searching for enhance *More* or *Less* avidly than the organ

3. When is the greatest attenuation difference expected between the organ and the lesion
# Liver Metastasis/Tumors

<table>
<thead>
<tr>
<th>Hypovascular</th>
<th>Hypervascular</th>
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<tbody>
<tr>
<td>Colon</td>
<td>HCC</td>
</tr>
<tr>
<td>Gastric adeno</td>
<td>Adenoma</td>
</tr>
<tr>
<td>Pancreas adeno</td>
<td>FNH</td>
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<tr>
<td>Sm bowel adeno</td>
<td>Neuroendocrine</td>
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<tr>
<td>Breast</td>
<td>Carcinoi, islet cell,</td>
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<tr>
<td>Lung</td>
<td>GIST</td>
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<td></td>
<td>Pheochromocytoma</td>
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<td></td>
<td>Ocular melanoma</td>
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<td></td>
<td>Renal cell</td>
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<td>Medull thyroid</td>
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</tbody>
</table>

These tumors enhance less avidly than normal liver.

These tumors enhance earlier and more avidly than normal liver.
What is normal?

You need to understand the normal enhancement pattern of the abdominal organs

- To know how to prescribe scans
- To identify pathology in appropriate phases
- To distinguish abnormal
150ml at 5cc/sec

Liver enhances maximally later (*)

C & D = Late arterial phase

Panc enhances maximally before the liver

G & H = PV phase

Target Organ enhancement

5 cc/sec injection rate

Normal Organ enhancement
Time attenuation curves

- **Dependent on**
  - **Contrast type**
    - Varies from omnipaque 300- isovue 370 mg/ml
  - **Total volume injected**
  - **Injection rate**
Slower injection rates results in lower peak enhancement and slower time to peak enhancement.
Defining the phases of imaging

- Arterial
  - True
  - Late
- Portal venous
- Nephrographic
- Delayed
“True” arterial phase
~25 sec
Only the arteries are opacified
PV is not yet enhanced
Renal cortex enhances

*CTA, reformating
Late arterial or ‘arterial dominant’ phase
~35 sec
Still arterial phase, but some filling of PV
HVs will not yet be opacified, liver not yet maximally enhanced
Renal cortex avidly enhances
Pancreas enhances maximally in this phase
Portal venous phase

~60-70 sec
Portal vein fully opacified
HVVs now opacified
*maximal liver parenchymal enhancement occurs during this phase
Nephrographic phase

90-110 sec
Uniform enhancement of renal cortex and medulla; NO cortico-medullary differentiation
No excretion yet
Liver, pancreas now starting to wash out
How do we time scanning

1. Fixed time delay

2. Test bolus (15-20cc), scan at given area and look for contrast bolus to arrive, then calculate time

3. Automated bolus tracking
   - Place ROI on specific structure (will differ depending on scan type), start injecting, repetitively scan at level of ROI, set HU threshold, scan begins when threshold reached
Threshold 120 HU

Sequential images following injection

ROI in abd aorta

Scanning triggered at this point