### 2001a(15): Compare and contrast the pharmacology of esmolol and propranolol

<table>
<thead>
<tr>
<th>Property</th>
<th>Esmolol</th>
<th>Propranolol</th>
</tr>
</thead>
</table>
| **Uses** | AF, atrial flutter  
Peri-operative HT  
MI | HT, angina, essential tremour,  
anxiety, thyrotoxicosis, HOCM,  
Pheo prophylaxis, migraine |
| **Physicochemical** | | |
| Presentation | Solution for injection (10/250mcg/ml)  
pH 5.5 (pain on injection) | Tablets (10, 40, 80, 160mg), solution for injection (1mg/ml) |
| Isomerism | Nil | Racemic mixture  
S-isomer → most effects  
R- → prevent T₄→T₃ |
| Routes/doses | IV only | PO: 30-320mg/day (bd→tds)  
IV: 1-10mg |
| **Pharmacodynamics** | | |
| Mechanism of Action | Selective β₁ block  
“sympathomimetic activity”  
Peak effect 10min  
Off by 20min | Non-selective β₁/β₂ block  
“Sympathomimetic activity”  
High doses inhibits Na⁺ ion flux → membrane stabiliser |
| CVS | Neg inotrope  
Neg chronotrope  
Similar ↓CO to propranolol | Neg inotrope  
Neg chronotrope  
↓CO by ~20%  
↓MRO₂  
↓MAP → poorly defined  
?central effect |
| Respiratory | Minimal effect | ↓FEV₁ ₂°↑airways resistance  
↓ventilatory response to  
↑PaCO₂ |
| CNS | ↓CBF ₂°↓MAP → ↓ICP | Cross BBB → ↓tremor, ↓IOP,  
anxiolytic  
↓ICP, ↓vasospasm |
| GU | Nil | ↓uterine tone |
| Metabolic | Min | ↓renin (β, block JGA)→  
↓aldosterone  
↓FFA  
↓gluconeogenesis |
| Side Effects | Less likely to produced HF,  
Heart block | HF, heart block  
Bronchospasm  
Nightmares  
Mask Sx ↓BSL  
↓exercise tolerance Abrupt  
cessation → angina, V  
arrhythmias, MI, sudden death |
| Drug interactions | ↑recovery time from sux (5-8min) | Displace fentanyl from lungs |
| **Pharmacokinetics** | | |
| Absorption | IV only | 90% PO  
Bioavailability 30% ₂° 1st pass metabolism |
| Distribution | Lipid soluble (+++)  
60%protein bound  
Vd 3.5L/kg | Lipid soluble (+++)  
95%protein bound (AAG)  
Vd 3.5L/kg |
| Metabolism | Plasma hydrolysis→red cell | Hepatic metabolism: oxidative |

By Amanda Diaz
<table>
<thead>
<tr>
<th>Metabolism</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esterase</td>
<td>Major acid metabolite has weak β-blocker activity</td>
</tr>
<tr>
<td></td>
<td>deamination → dealkylation → glucuronidation</td>
</tr>
<tr>
<td></td>
<td>4-hydroxy metabolite active ↓ dose in liver failure</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Elimination</th>
<th>Process</th>
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<tbody>
<tr>
<td>Renal: &lt;1% unchanged</td>
<td>CL 285ml/min/kg</td>
</tr>
<tr>
<td>Renal disease → caution</td>
<td>t½β 10min</td>
</tr>
<tr>
<td>major acid metabolite renally excreted (t½β 3.5hrs)</td>
<td>Renal: &lt;1% unchanged</td>
</tr>
<tr>
<td>Renal: &lt;1% unchanged</td>
<td>t½β 3hrs</td>
</tr>
<tr>
<td>Renal disease → caution</td>
<td>Nil effect renal failure</td>
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