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Case Study of Atenolol

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Abstract: Atenolol, which is a cardioselective blocker of the beta-1 adrenergic receptors, is frequently used to treat hypertension, angina pectoris, and cardiac arrhythmias. The following is a case report of a 52-year-old man patient diagnosed with stage 2 hypertension (BP 168/102 mmHg) with a background history of exertional mild angina. Upon baseline assessment, the patient was started on Atenolol 50 mg daily. At 12-week follow-up, the patient demonstrated significant improvement in the control of blood pressure (mean BP lowered to 130/84 mmHg), reduction in the number of anginal attacks, and absence of serious side effects. Heart rate decreased from 88 bpm to 68 bpm with increased exercise tolerance. Slight fatigue was noticed in the initial period but subsided by the fourth week. The case highlights the ability of Atenolol to control both hypertension and accompanying angina, with an excellent safety profile in an outpatient environment. It is also underlines the need for individualized treatment, follow-up, and patient education on compliance and lifestyle change.

Keywords**:** *Atenolol, Hypertension, Beta-Blocker, Angina, Case Study, Cardioselective, Blood Pressure, Heart Rate.*

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I. INTRODUCTION

Atenolol is a beta-1 adrenergic receptor blocker that is cardioselective.It was created to treat cardiovascular diseases such as hypertension, angina pectoris, and to decrease mortality in acute myocardial infarction.Atenolol was launched in 1976 by ICI Pharmaceuticals (now AstraZeneca) as a safer option compared to non-selective beta-blockers such as propranolol.

➢ *Need for Development*

Propranolol, which was a common beta-blocker at the time, worked well but crossed the blood-brain barrier and tended to produce CNS side effects such as fatigue, depression, and sleep disturbances. There was a clinical need for a hydrophilic, cardioselective beta-blocker with less central nervous system side effects.

➢ *Introduction & Approval*

Atenolol (trade name: Tenormin) was launched in 1976 and became popular soon after.

➢ *Approved by the FDA for:*

- Hypertension
- Angina
- Post-myocardial infarction treatment

➢ *Clinical Advantages*

- *Beta-1 Selectivity:*

Acts on the heart more than the lungs, reducing respiratory side effects.

- *Hydrophilic:*

Less likely to penetrate the blood-brain barrier —> fewer CNS side effects. Greater half-life than propranolol —> once-daily dosing. Enhanced compliance and safety in elderly patients and patients with respiratory diseases such as asthma.

➢ *Impact*

- Became one of the most widely prescribed beta-blockers in the world.
- Featured on the World Health Organization's List of Essential Medicines.
- Commonly used over decades, particularly in low- and middle-income nations.

➢ *Decrease in Usage*

- Subsequent research (e.g., LIFE trial) indicated atenolol could be less efficient than other antihypertensive drugs at preventing stroke.
- Guidelines (e.g., JNC 8, NICE) regraded atenolol as a first-line drug for uncomplicated hypertension.
- But still utilized for certain uses, particularly for post-MI and angina.

II. LITERATURE SURVEY

➢ *Development and Pharmacological Profile*

Atenolol's development was reported in initial research by Frishman et al. (1976) and Channer & Jones (1979), emphasizing its beta-1 selectivity and advantageous pharmacokinetic profile over propranolol. The drug was

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formulated to counteract the CNS-associated side effects of previous non-selective beta-blockers through its hydrophilic nature and restricted penetration through the blood-brain barrier.

➢ *Clinical Efficacy*

A number of randomized controlled trials have proven Atenolol to be effective in the treatment of hypertension and angina pectoris. The MRC Trial (1985) proved Atenolol to be effective in reducing blood pressure, though the long-term cardiovascular effects were controversial. Psaty et al. (2003) stated that although atenolol lowered blood pressure, it was less effective in preventing stroke than other antihypertensives.

➢ *Use in Myocardial Infarction*

Atenolol's place in acute myocardial infarction (MI) was confirmed by trials such as the ISIS-1 study (1986), which showed a dramatic decrease in mortality when administered early following MI. It emerged as a pillar in post-MI beta-blockade therapy, due to its cardioselectivity and safety profile.

➢ *Comparative Effectiveness*

2000s literature, including meta-analyses such as that by Lindholm et al. (2005), challenged Atenolol's efficacy for long-term reduction of cardiovascular risk, particularly for stroke prevention. This created a change in guidelines with other agents such as ACE inhibitors or calcium channel blockers being recommended for first-line therapy in uncomplicated hypertension.

➢ *Current Position in Guidelines*

Despite a general fall in popularity, Atenolol is still an important drug in some clinical situations. ESC and ACC guidelines recommend Atenolol for:

- Angina
- Post-MI treatment

Control of rate in arrhythmias This is a testament to lingering faith in its cardioselectivity and tolerability, particularly in patients with co-existing respiratory disease.

➢ *Global and Public Health Impact*

Being listed on the WHO Model List of Essential Medicines, Atenolol remains relevant worldwide, particularly in resource-constrained environments. Its accessibility, established safety, and simplicity render it a convenient option in public programs of health.

- *Drug Profile*

✓ **Generic Name**: Atenolol
✓ **Brand Names:** Tenormin, Atenix, others
✓ **Class:** Beta-1 selective adrenergic receptor blocker

➢ *Mechanism of Action:*

Atenolol selectively inhibits β1-adrenergic receptors in the heart, decreasing heart rate, myocardial contractility, and cardiac output, thus decreasing blood pressure and myocardial oxygen demand.

➢ *Pharmacokinetics*

- **Absorption:** Oral bioavailability ~50%
- **Distribution:** Limited CNS penetration due to hydrophilicity
- **Half-life:** ~6-9 hours
- **Metabolism:** Minimal hepatic metabolism
- **Excretion**: Mainly renal (~85% unchanged in urine)

➢ *Clinical Indications*

- Hypertension (particularly in young patients or those with tachycardia)
- Angina pectoris
- Post-myocardial infarction (prevention of recurrence)
- Arrhythmias (particularly supraventricular tachycardias)
- Off-label indications: Prophylaxis against migraine, symptoms of hyperthyroidism, anxiety

➢ *Contraindications and Precautions*

- *Contraindications:*

✓ Bradycardia
✓ Heart block >1st degree
✓ Cardiogenic shock
✓ Severe peripheral arterial disease
✓ Untreated heart failure

- Caution in:

✓ Asthma/COPD (potential for bronchospasm)
✓ Diabetes (may obscure hypoglycemia)
✓ Renal impairment (dose reduction required)

➢ **Adverse Effects**

- **Common:**

✓ Fatigue, dizziness
✓ Bradycardia
✓ Cold extremities

- **Serious**

✓ Heart block
✓ Bronchospasm (particularly in asthma)
✓ Depression, insomnia

➢ *Drug Interactions*

With other antihypertensives → additive hypotensive effect With non-dihydropyridine CCBs (such as verapamil, diltiazem) → enhanced risk of bradycardia or heart block NSAIDs can diminish antihypertensive effect

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➢ *Patient Case Study*

- Patient Profile:

✓ **Name:** Mr. Rajesh Singh
✓ **Age**: 58
✓ **Medical History:** Hypertension (7 years), Type 2 Diabetes, Mild COPD
✓ **Current Complaint:** Increased frequency of chest discomfort and higher BP (160/95 mmHg)

- **Clinical Findings:**

✓ HR: 88 bpm
✓ **ECG:** Normal sinus rhythm, no ischemic changes
✓ **Labs:** FBS 132 mg/dL, eGFR normal, HbA1c 7.2%
✓ **Echocardiogram:** EF 55%, mild LVH

- **Treatment Plan**

✓ Initiated on Atenolol 50 mg OD
✓ Reason: Underlying hypertension and potential exertional angina
✓ Other Meds: Metformin, Amlodipine, Aspirin
✓ Follow-up (4 weeks):
✓ BP: 128/82 mmHg
✓ HR: 68 bpm
✓ No chest pain
✓ Mild fatigue reported, no respiratory symptoms

- **Adjustment**

✓ Carried on Atenolol
✓ Directed dose reduction in case of increased fatigue
✓ Monitoring for any deterioration in COPD symptoms
✓ Outcome (12 weeks):
✓ BP and HR stable
✓ Anginal episodes abolished
✓ No major side effects
✓ Good tolerance reconfirmed

III. DISCUSSION

- Atenolol was useful in this scenario because:
- Cardioselectivity (safer in mild COPD)
- Dual benefit in hypertension and angina
- Improved compliance with once-daily dosing
- A beta-blocker such as bisoprolol or metoprolol succinate may, however, be considered in long-standing COPD cases for even greater safety.

IV. CONCLUSION

Atenolol, a β-selective blocker, was a good and well-tolerated choice in treating hypertension and angina in the patient being reported. Its selectivity of action on β1 receptors made it possible to confer cardiovascular advantage without causing major respiratory side effects and thus can be used even in a patient with mild COPD. The drug was effective in lowering the blood pressure and heart rate of the patient with improvement in symptoms of chest tightness without notable side effects. This case highlights the need for personalized medicine—selecting the correct drug according to the comorbidities, risk factors, and tolerability of the patient. Although atenolol is less commonly preferred over newer beta-blockers in certain guidelines, it can still be an excellent option if prescribed judiciously and closely monitored.

➢ *Key Lesson:*

Atenolol can be a good asset in cardiovascular therapy when it is prescribed keeping individual patient profiles in mind and with close clinical monitoring.

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