LIPID DISORDERS

Background

LIPID disorders are important for three reasons:
- They contribute to cardiovascular disease, still the number one cause of death in our society, by aggravating atherosclerosis.
- They are common and are treatable, mainly with statins, which have revolutionised preventive medicine in the last few decades.
- In Australia, more than a million adults take lipid-modifying drugs, at an annual cost of about $1.1 billion to the PBS.

Indications for lipid-modifying drugs
The indications for using lipid-modifying drugs are to:
- Reduce the incidence of CVD through primary and secondary prevention.
- Reduce itching in obstructive jaundice, due to deposition of bile acids in the skin, by the use of bile-acid sequestrants (resins).
- Prevent acute pancreatitis, a potentially fatal complication of very high triglyceride (TG) levels (>11mmol/L).
- Induce regression of lesions caused by high levels of low-density lipoprotein.
Lipid levels for PBS subsidy
TC >9mmol/L or TG >8mmol/L

**PBS criteria for reimbursement of lipid-lowering drugs**

Very high-risk patients do not require the usual lipid criteria for reimbursement of lipid-lowering therapy, nor do they require a prior lifestyle modification program. This category includes patients with:

- Symptomatic CVD
- Significant microalbuminuria (urinary albumin creatinine ratio >2.5 [males] or >3.5 [females])
- Diabetes mellitus in Aboriginal or Torres Strait Islander people.
- Age 60+.

Other patients require a six-week lifestyle modification period before repeat lipid testing and reassessment of eligibility under the criteria in table 1.

**Clinical presentation**

**Symptoms of lipid disorders**

MOST lipid disorders are asymptomatic. Symptoms may arise from associated comorbidities, some of which are caused by the lipid disorder (eg, angina from coronary atherosclerosis secondary to high LDL-C levels; acute abdominal pain from acute pancreatitis secondary to high TG levels).

**Signs of lipid disorders**

Most lipid disorders are not detectable clinically unless extremely high levels of lipids are present, generally for a prolonged period.

- **Eruptive xanthomas**
  - Very high TG levels (usually >5mmol/L), and often >20mmol/L, may present with eruptive xanthomas. These are painless, non-tender small maculopapular lesions with a yellowish centre, surrounded by an area of erythema. Eruptive xanthomas generally occur on extensor surfaces of the elbows, lower back, buttocks and limbs. They may persist for several weeks until TG levels are lowered, after which they can completely resolve over a few weeks.

- **Lipaemia retinalis**
  - Examination of the fundi in these patients may reveal the presence of yellow-white, creamy fundal vessels due to the presence of TG-rich lipoproteins, especially chylomicrons.

- **Planar xanthomas**
  - Uncommonly, very high levels of intermediate-density lipoproteins (IDL), as occurs in familial dyslipoproteinemia (type III disorder; see below), may result in xanthomas that are yellowish, flat linear lesions occurring along the creases of the palms.

- **Other xanthomas**
  - Very high levels of LDL-C result in premature and extensive deposition of LDL-C in the cornea, tendons, eyelids and skin, resulting in arcus senilis, tendon xanthomas, xanthelasmas and cutaneous (tuberous) xanthomas. These lesions suggest the presence of familial hypercholesterolaemia or other genetic disorders resulting in a similar phenotype (see below).

- **Very early xanthomas**
  - Difficult to see without using a hand torch to reflect light obliquely from the edge of the cornea. It is seen as a very faint, milky, thin arcuate opacity. It is readily seen, however, with a slit lamp.

**Table 1: Criteria for reimbursement of lipid drugs for those patients not at very high risk**

<table>
<thead>
<tr>
<th>Patient category</th>
<th>Lipid levels for PBS subsidy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus (not high-risk)</td>
<td>TC &gt;6.5mmol/L</td>
</tr>
<tr>
<td>Aboriginal or Torres Strait Islander</td>
<td>TC &gt;6.5mmol/L or TC &gt;5.5mmol/L and HDL-C &lt;1mmol/L</td>
</tr>
<tr>
<td>Hypertension</td>
<td>TC &gt;6.5mmol/L</td>
</tr>
<tr>
<td>HDL-C &lt;1.0mmol/L</td>
<td></td>
</tr>
<tr>
<td>Familial hypercholesterolaemia identified by:</td>
<td>If aged &lt;18 at treatment initiation, LDL-C &gt;4mmol/L</td>
</tr>
<tr>
<td>DNA mutation</td>
<td>If aged &gt;18 at treatment initiation:</td>
</tr>
<tr>
<td>Tendon xanthomas in the patient or a first- or second-degree relative</td>
<td>LDL-C &gt; 5mmol/L, or</td>
</tr>
<tr>
<td>Family history of symptomatic CHD:</td>
<td>TC &gt; 6.5mmol/L, or</td>
</tr>
<tr>
<td>Before age 60 in one or more first-degree relatives</td>
<td>TC &gt; 5.5mmol/L and HDL-C &lt;1.0mmol/L</td>
</tr>
<tr>
<td>Before age 50 in one or more second-degree relatives</td>
<td>TC &gt;7.5mmol/L or TG &gt;4mmmol/L</td>
</tr>
<tr>
<td>Patients not eligible under the above criteria:</td>
<td>TC &gt;8mmol/L or TG &gt;8mmmol/L</td>
</tr>
<tr>
<td>Men aged 35-75</td>
<td></td>
</tr>
<tr>
<td>Postmenopausal women aged up to 75</td>
<td></td>
</tr>
<tr>
<td>Patients not otherwise included</td>
<td></td>
</tr>
</tbody>
</table>
Investigations

Table 2: Patterns of lipid profile according to underlying aetiology

<table>
<thead>
<tr>
<th>Lipid disorder</th>
<th>Primary causes</th>
<th>Secondary causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypercholesterolaemia:</td>
<td>Mutation of LDL-receptor gene (familial hypercholesterolaemia)</td>
<td>• Hyperlipidaemia</td>
</tr>
<tr>
<td>• High TC and LDL-C</td>
<td>Mutation of apolipoprotein gene (familial defective apoB)</td>
<td>• High triglycerides (type III)</td>
</tr>
<tr>
<td>• Normal or slightly high TG</td>
<td></td>
<td>• Hypercholesterolaemia (familial)</td>
</tr>
<tr>
<td>• HDL-C near-normal</td>
<td></td>
<td>• Hypertriglyceridaemia</td>
</tr>
<tr>
<td>Combined hyperlipidaemia:</td>
<td></td>
<td>• Polygenic</td>
</tr>
<tr>
<td>• High TC plus high TG levels</td>
<td></td>
<td>• Diabetes mellitus (type 2)</td>
</tr>
<tr>
<td>• LDL-C may be normal or</td>
<td></td>
<td>• Hypothyroidism</td>
</tr>
<tr>
<td>isolated or reduced (direct</td>
<td></td>
<td>• Anemia</td>
</tr>
<tr>
<td>LDL-C reduced</td>
<td></td>
<td>• Myeloma</td>
</tr>
<tr>
<td>Hypertriglyceridaemia:</td>
<td></td>
<td>• Cholestasis</td>
</tr>
<tr>
<td>• TG often &gt;4.5mmol/L</td>
<td></td>
<td>• Pregnancy</td>
</tr>
<tr>
<td>Combined hyperlipidaemia:</td>
<td></td>
<td>• Uncontrolled diabetes</td>
</tr>
<tr>
<td>• TG increased</td>
<td></td>
<td>• Alcohol excess</td>
</tr>
<tr>
<td>• LDL-C near-normal or reduced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HDL-C low-reduced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolated low HDL-C:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HDL-C low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Near-normal TG, TC, LDL-C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined hyperlipidaemia:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• TG increased</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• TG increased</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• LDL-C levels (direct assay)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HDL-C reduced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High HDL C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No specific gene identified</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ‘fire-and-forget’ strategy involves prescribing a given dose of statin (sufficient to lower LDL-C by the required amount, according to predetermined tables), and continuing therapy without further dose titration or LDL-C measurement. This strategy was first suggested after publication of the Heart Protection Study, in which all patients at high CVD risk were treated with a fixed dose of simvastatin (40mg/day). This was remarkably well tolerated, probably as the result of a run-in period during which patients intolerant to statin therapy were withdrawn.

A modified fire-and-forget strategy was recently described using data from the modified fire-and-forget strategy based on current US guidelines, the modified fire-and-forget strategy prevented a greater number of CVD events and deaths.[7] The third strategy, aiming to achieve at least 30% LDL-C reduction (usually with statin therapy), is included in current Canadian guidelines as an acceptable alternative to treating-to-target.[8] A large CV outcomes trial in the real world of clinical practice is required to test the strengths and weaknesses of the different strategies. For the present, treat-to-targret is the most widely used and recommended strategy.

Figure 8: Percentage reduction in CVD events according to achieved LDL-C levels in statin trials. (adapted from Cholesterol Treatment Trials Collaboration, University of Oxford, 2006 [www.chtst.co.uk/projects/ctt/])

Reduction in CVD events

<table>
<thead>
<tr>
<th>Approximate % reduction in CVD events</th>
<th>LDL-C achieved with statin</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>2.0 mmol/L</td>
</tr>
<tr>
<td>44%</td>
<td>0 mmol/L</td>
</tr>
</tbody>
</table>

Assessment of compliance and individual response to therapy are important benefits of this strategy. The ‘fire-and-forget’ strategy involves prescribing a given dose of statin (sufficient to lower LDL-C by the required amount, according to predetermined tables), and continuing therapy without further dose titration or LDL-C measurement. This strategy was first suggested after publication of the Heart Protection Study, in which all patients at high CVD risk were treated with a fixed dose of simvastatin (40mg/day). This was remarkably well tolerated, probably as the result of a run-in period during which patients intolerant to statin therapy were withdrawn.

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HDL-C targets

The Australian guidelines suggest a target LDL-C >1.0mmol/L, while other guidelines specify different targets of >1.0mmol/L for men, and ≥1.2mmol/L for women. Unlike for LDL-C, HDL-C targets are largely based on epidemiological studies.
Lipid disorders

Table 3: Dietary therapy for lipid disorders*  

<table>
<thead>
<tr>
<th>Lipid disorder</th>
<th>Diet</th>
<th>Dietary supplements</th>
</tr>
</thead>
<tbody>
<tr>
<td>High LDL-C</td>
<td>Low total or saturated fat High unsaturated fat Low choles ter Mediterranean-type diet Low-GI carbohydrates</td>
<td>Plant sterols (margarine) Soluble fibre</td>
</tr>
<tr>
<td>Low total or saturated fat High unsaturated fat Low cholesterol Mediterranean-type diet Low-GI carbohydrates</td>
<td>Fish oils</td>
<td></td>
</tr>
<tr>
<td>Combined hyperlipidaemia</td>
<td>Low saturated fat High unsaturated fat Mediterranean-type diet Low-GI carbohydrates Restrict or avoid alcohol</td>
<td>MCT if severe*</td>
</tr>
<tr>
<td>High TG</td>
<td>Low total fat Low-GI carbohydrates Restrict or avoid alcohol</td>
<td>Fish oils</td>
</tr>
<tr>
<td>Low HDL-C</td>
<td>Mediterranean-type diet Low-GI carbohydrate</td>
<td></td>
</tr>
</tbody>
</table>

*Adapted from Colquhoun D. How to Treat Hyperlipidaemia, 2006

**Medium-chain triglycerides (MCT) are not converted by the intestine into lipopro teins (especially chylomicrons), and may be used to supply non-essential fatty acids in those with very high TG levels.

Figure 9: Benefits of multiple risk factor intervention on five-year CVD risk according to age with 10% baseline risk at age 50. (adapted from www.reynoldsriskscore.com).

Table 4: Use of lipid drugs in clinical practice

<table>
<thead>
<tr>
<th>Patient group</th>
<th>Initial treatment</th>
<th>LDL-C not at goal</th>
<th>TG or HDL-C not at goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary prevention and high-risk primary prevention</td>
<td>Statin</td>
<td>1. Exclude or control secondary causes 2. Add ezetimibe 3. Add low-dose resin 4. Add fenofibrate 5. Add nicotinic acid or refer†</td>
<td>1. Exclude or control secondary causes 2. Fish oil (moderate dose)* 3. Nicotinic acid or refer†</td>
</tr>
<tr>
<td>Other primary prevention, TG &lt;4.5mmol/L</td>
<td>Statin</td>
<td>As above</td>
<td>As above</td>
</tr>
<tr>
<td>TG &gt;4.5mmol/L</td>
<td>Fibrate</td>
<td>1. Exclude or control secondary causes 2. Statin (only with fenofibrate) 3. Fish oil (usually high-dose)* 4. Nicotinic acid or refer†</td>
<td>1. Exclude or control secondary causes 2. Increase doses of statin/fish oil/nicotinic acid 3. Consider other combinations or refer†</td>
</tr>
<tr>
<td>Lp(a) high</td>
<td>1. Nicotinic acid* 2. Statin* 3. Antiplatelet therapy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Doses of over-the-counter fish oil: moderate 2-3 capsules (each 1g, containing ~30% DHA/EPA); high 6-12 capsules (1g, High-dose capsules (Maxico), 1g each, containing ~84% DHA/EPA, are likely to become available on prescription in the near future for post-MI patients (1g bd) and for hypertriglyceridaemia (2-4 daily) or equivalent liquid formular.  

**Use of immediate-release nicotinic acid requires specific protocol; highest tolerated dose recommended to maximum 3g/day (see text)  

†Referal may be considered at earlier stages, especially with very abnormal lipid levels or with adverse events

 avoids drug titration. This strategy can improve compliance.

• Obtain a baseline history of muscle aches, pains, cramps and stiffness, as these are the most frequent adverse effects with statins.

• Check baseline levels of CK and transaminases, as these can be increased with statins and may reflect muscle or liver cell injury. Repeat after 8-12 weeks of initial therapy (and at the same period after dose up-titration). Levels should then be repeated annually, or for CK if unexplained muscular skeletal symptoms (MSS) occur.

• Dose adjustment may be necessary with renal impair ment (for statins with pre dominantly renal excretion, such as rosuvastatin and simvastatin) or hepatic impairment (for statins predominantly metabolised by the liver, such as simvastatin, lovastatin and fluvastatin).

• Use lower doses for elderly women and others with low muscle mass, MSS and CK should be monitored more frequently in these patients (2-3 times yearly).

• Use caution in treating patients with recognised myopathy or previous MI (or not in statin related). MSS and CK should be monitored at least page 32.
from page 30
be monitored more frequently in these patients.
Certain adverse drug reactions should not be routinely pre-
scribed with statins, as there is no evidence to support
their use in asymptomatic, elderly, normolipidemic patients, and data are conflicting in those with myalgia.

Managing adverse events with statins
Table 5 summarises how to manage adverse events with statin therapy.

**Table 5: How to manage adverse events with statin therapy**

<table>
<thead>
<tr>
<th>Event</th>
<th>Initial treatment</th>
<th>Subsequent treatment</th>
<th>Long-term treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased transaminase levels (AST, ALT)</td>
<td>Withdraw or reduce statin dose if &lt;3 × ULN</td>
<td>Repeat CK after 1-2 weeks Withdraw, use lower dose or change statin if symptoms persist</td>
<td>Monitor more frequently (six monthly)</td>
</tr>
<tr>
<td>Myalgia (pain, stiffness) with CK &lt;3 × ULN</td>
<td>Continue statin Check secondary cause and treat if indicated*</td>
<td>As above</td>
<td>Consider non-statin if statin intolerant</td>
</tr>
<tr>
<td>Myalgia with CK &lt;3 × ULN</td>
<td>Withdraw statin Continue secondary cause and treat if indicated</td>
<td>As above</td>
<td>Consider non-statin if statin intolerant</td>
</tr>
<tr>
<td>Myositis (more severe symptoms, including weakness with CK ≥30 × ULN)</td>
<td></td>
<td>As above</td>
<td></td>
</tr>
<tr>
<td>Rhabdomyolysis (severe symptoms, CK &gt;10 × ULN with myoglobinuria and impaired renal function)</td>
<td>As above</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Possible contributors to residual risk in patients on statin therapy**
- **Cigarette smoking**
- **Uncontrolled hypertension**
- **Impaired glucose tolerance**
- **Reduced physical exercise**
- **Central abdominal obesity**
- **Inflammatory markers**
- **Increased fibrinogen**
- **Pro-thrombotic tendency**
- **Myocardial ischaemia**
- **Left ventricular hypertrophy**
- **Renal insufficiency**
- **Increased LDL-C**
- **Atherogenic dyslipidaemia**: increased apolipoproteins (Apo) and small dense LDL reduced HDL-C increased TG/HDL-C increased triglycerides (TG) and TG-rich lipoproteins

- **Of those with established CVD or diabetes, 42% were untreated and only 59% of those being treated reached target LDL-C levels.**
- **Of those without CVD or diabetes, 38% achieved target LDL-C levels, and 31% of patients with high TC/CVD risk did not receive lipid treatment for primary prevention.**
- Some features are similar to those published from Europe, the UK and US over the past decade.

**Residual risk**
- Residual risk refers to CVD events that occur despite individual therapy. In controlled trials, statins reduce CVD events by 10-40% compared with placebo, with people aged 50-70.
- The two important implications of residual risk are that statins are not the complete answer to prevention of CVD, and that other thera-
- pies must also be considered and used in conjunction with appropriate clinical trials.
- Possible contributing factors are listed in the box (left).
- Lifestyle measures as a means of improving residual risk is likely to be significant. These include:
  - **Stopping smoking.**
  - **Increasing aerobic capacity through exercise.**
  - **Low-caloric, high fat meal.**

**Fibrates**
Fibrates have wide-ranging effects because of multiple gene activation and repres-
- With LDL-C levels ≥70% in responsive patients, greater with reduction of TC, LDL-C, and TG, and increased HDL-C compared with statin alone. Greater reduction in high-sensitivity (hs) CRP was achieved. The occasional add-on to a given dose of statin is equivalent to three doses of statin, and when each doubling reduces LDL-C by about 6% (rule of 6).

**Fibrate**
Fibates have wide-ranging effects because of multiple gene activation and repres-
- Increased sporadic myopathy
- Increased HDL-C levels
- Increased lipoprotein lipase activity
- Reduced TG levels
- Variable effects on LDL-C levels (from up to 20% reduction to no change, depending on the popula-
  - Large scale CVD outcome trials have established that fibrate therapy have resulted in a statistically
- Many GPs recommend a glass of red wine daily to mit-
  - Reduces hepatic production of LDL-C and apolipoprotein B, leading to reduced plasma TG, LDL-C and increased HDL-C.
- Also has anti-inflammatory effects that may contribute significantly to its anti-atherogenic
- Immediate-release NA is a third-line drug because of the high incidence of side effects resulting in drug withdrawal (up to 80%). The main side effect is skin flushing and itching, mediated by release of prostaglandins after interac-
  - NA is metabolised to nicoti-

**Nicotinic acid**
Nicotinic acid (NA) is vitamin B3, physiological doses (250mg tablets) should be taken after food, initially at 250mg tablets, then 1 to 2 tablets every 4-7 days, depending on tolerability.
- Flushing tends to decrease with longer use but is often useful (including sudden intolerable in higher doses (>1.5g/day). Prior treatment with slow-release aspirin may improve cutaneous flushing and compliance with nicotinic acid.

**Drugs causing secondary lipoprotein disorders**
Current medications need to be reviewed with patients with lipid disorders, and offending
- These include anabolic steroids, (HDL-C), glucocorticosteroids, beta blockers, smoking, alcohol, arachidonic acid, (cholestyramine, colestipol), oestrogen, or anticoagulants, diuretics (TGT) and protease inhibitors (TGT, LDL-C, HLD-C).

**Familial hypercholesterolemia**
Familial hypercholesterolemia (FH) is inherited as an auto-
- High LDL-C (about twice the normal level, other lipids being near normal).
- Signs of LDL-C deposition (see figures 1-7).
- Family history of premature CVD or thrombosis (this may include TGA death before age 55) or (60) females).
- Early recognition and treat-
- The occasional non-respon-
- High LDL-C with high LDL-C Patients with high levels of HDL-C as well as LDL-C are a dilemma to clinicians because they often have a normal cho-
- High HDL-C with high LDL-C Patients with high levels of HDL-C as well as LDL-C are a dilemma to clinicians because they often have a normal cho-
- Increased TG/HDL-C increased triglycerides (TG) and TG-rich lipoproteins

**How are we doing with lipid management?**
A recent Australian study showed there is still a long way to go for all patients to be treated according to national guidelines:


cord page 34
**How to Treat Quiz**

**Lipid disorders—9 July 2010**

1. Which TWO statements are correct? 
   a) Statins effectively treat the pruritus of obstructive jaundice 
   b) Lipid-lowering drugs are indicated for the prevention of pancreatitis due to very high triglyceride (TG) levels 
   c) Patients with symptomatic CVD or a family history of premature CVD are eligible for PBS-subsidised lipid-lowering therapy irrespective of their lipid levels 
   d) Eruptive xanthomas tend to occur in those with very low high-density lipoprotein (HDL-C) levels 
   
2. Which TWO statements are correct? 
   a) ApoB and apoA-1 may be better CVD risk discriminators than LDL-C and HDL-C 
   b) Familial dysbetalipoproteinaemia is suspected when TG level is raised and TC level is >5.5 mmol/L 
   c) The reduction in CVD absolute risk with apoA-1 and apoB1 is protective against CVD 
   d) Fish oils are the most effective dietary treatment for each group 

3. Which TWO statements are correct? 
   a) The Friedewald formula used to calculate LDL-C level is valid when TG is ≤4.5 mmol/L 
   b) The fire-and-forget treatment strategy has been shown to prevent a greater number of CVD deaths than the treat-to-target strategy 
   c) ApoB and apoA-1 are better indicators of cardiovascular risk than LDL-C or HDL-C 
   d) No dose adjustment of statin is necessary in Indians, who have high CVD risk 

4. Which THREE statements are correct? 
   a) Secondary causes of hypercholesterolaemia include hypothyroidism and myeloma 
   b) Familial dyslipidaemia is suspected when TG level is raised and TC level is normal 
   c) Insulin resistance disorders and alcohol excess are common secondary causes of cholesterol (LDL-C) levels 
   d) Isolated low HDL-C level is associated with cigarette smoking and a high-carbohydrate diet 

5. Which TWO statements are correct? 
   a) Lipoprotein (a) is a protective against CVD 
   b) Statins are effective in lowering LDL levels 
   c) ApoB and apoA-1 may be better CVD risk discriminators than LDL-C and HDL-C 
   d) LDL and triglyceride-rich lipoproteins (very low density lipoproteins and intermediate-density lipoproteins) contain apoB 

6. Which TWO statements are correct? 
   a) Measurement of apoB is most useful in combined hyperlipidaemia to detect the presence of small dense LDL-C 
   b) ApoB1 is protective against CVD 
   c) For patients with high CVD risk, the target level of LDL-C is <3.0 mmol/L 
   d) For patients with low CVD risk, the target level of LDL-C is <2.0 mmol/L. 

7. Which TWO statements are correct? 
   a) The fire-and-forget treatment strategy has the disadvantage of being more expensive than a treat-to-target strategy 
   b) A modified fire-and-forget strategy strategies patents into higher and lower five-year CVD risk groups, with a different standard treatment for each group 
   c) When compared with an intensive treat-to-target strategy, the modified fire-and-forget strategy prevents fewer CVD events and death 
   d) For TG levels >1.7 mmol/L, the nature of LDL particles changes from large and light (safe) LDL to small and dense (harmful) LDL 

8. Which TWO statements are correct? 
   a) Non-HDL-C is a measure of atherogenic cholesterol, when high TG makes the Friedewald formula inaccurate 
   b) Lowering TG levels may provide benefit in reducing CVD risk, independent of lowering LDL-C and raising HDL-C levels 
   c) The reduction in CVD absolute risk with multiple risk factor interventions is similar across the age spectrum 
   d) Fish oils are the most effective dietary supplement to lower LDL-C level 

9. Which TWO statements are correct? 
   a) Fenofibrate is the first-line pharmacotherapy for TG level >4.5 mmol/L. 
   b) For elevated LDL-C level insufficiently responsive to a statin alone, ezetimibe is the drug of first choice in combination with the statin 
   c) With statins, start with a low dose and titrate up as needed 
   d) No dose adjustment of statin is necessary in patients with low muscle mass 

10. Which TWO statements are correct? 
    a) If a patient on a statin has myalgia and CK level >3 × upper limit of normal, the statin should be continued 
    b) Additional reduction in CVD risk by adding a fibrate to statin therapy is confined to patients with high TG and low HDL-C levels 
    c) Nicotinic acid reduces TG and HDL-C, and increases HDL-C levels 
    d) Patients with raised LDL-C and HDL-C levels and a normal total cholesterol ratio do not need treatment with a statin

**How to Treat Quiz Online**

Complete this quiz online and fill in the GP evaluation form to earn 2 CPD or PDP points. We no longer accept quizzes by post or fax.

The mark required to obtain points is 80%. Please note that some questions have more than one correct answer.

**Online Only**

for immediate feedback

**CVD Quiz Update**

The RACGP requires that a brief GP evaluation form be completed with every quiz to obtain category 2 CPD or PDP points for the 2008-10 triennium. You can complete this online along with the quiz at www.australiandoctor.com.au. Because this is a review, we are no longer able to accept the quiz by post or fax. However, we have included the quiz questions here for those who like to prepare the answers before completing the quiz online.

**References**

Available on request from: julian.mcallan@reedbusiness.com.au

**Online Resources**

www.thetheart.org — the best site for CVD issues

Heart Foundation, for local references: www.heartfoundation.org.au

**PD Resources**

Dr Giovanna Zingarelli

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**How to Treat**

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