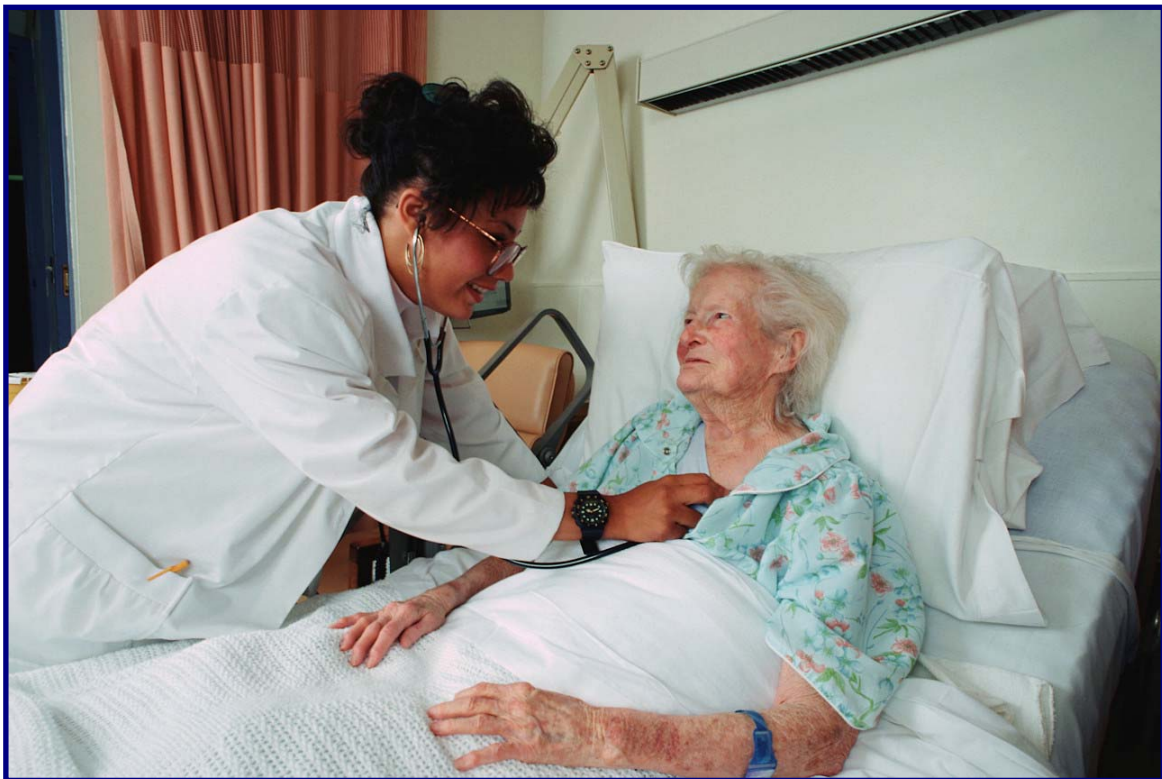


Metabolic and Endocrine Issues in ElderCare



Part of the
ElderCare: Healthcare for the Aging Series

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Introduction/Purpose Statement

Among the more challenging and complex difficulties faced by the elderly are problems with the endocrine system.

You will learn about:

- the normal changes we see in the aging person's endocrine status;
- abnormal changes including diabetes, hyperthyroidism, hypothyroidism, hyperlipidemia and thermoregulatory disorders; and the
- assessment and management of the elder experiencing endocrine disease.

Target Audience

This home study was designed for nurses with no familiarity with metabolic and endocrine issues in eldercare; however, all health care professionals are invited to complete this packet.

Content Objectives

1. Describe common metabolic/endocrine changes and pathophysiology related to aging.
2. Formulate a plan for assessing and managing the elderly patient with metabolic and endocrine disease.

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Introduction

Among the more challenging and complex difficulties faced by the elderly are problems with the endocrine system.

You will learn about:

- the normal changes we see in the aging person's endocrine status;
- abnormal changes including diabetes, hyperthyroidism, hypothyroidism, hyperlipidemia/hypercholesterolemia and thermoregulatory disorders; and the
- assessment and management of the elder experiencing endocrine disease.

Normal Changes of Aging

There are certain endocrine and metabolic changes that are expected in a healthy elder.

In general, endocrine function is decreased in the elderly. This results in the gradual elevation of the fasting glucose level by 6-14 mg/dl per decade after age 50. It is also common for elders to have hypoglycemia following meals, as well as hyperglycemia caused by insulin resistance.

On the other hand, many hormones remain constant both in amount produced and in the blood level, such as thyroid stimulating hormone (TSH), but the target organs don't respond to them as well.

Hormones that decrease with age are estradiol and estrogen in women following menopause, aldosterone, renin, calcitonin and growth hormone. The following table describes the risks associated with decreased levels of these hormones.

Hormone (decreased)	Effect
Parathyroid, calcitonin & growth hormone	Increased risk for osteoporosis
Aldosterone and renin	Increased risk for dehydration and hypotension
Estrogen and estradiol	Increased risk for cardiovascular disease

Metabolic and Endocrine Diseases

The most common metabolic and endocrine problems among the elderly (> 65 years of age) are:

Disease	Number affected
Diabetes	10.3 million or 20.9% of all people over the age of 60 in the U.S. are diabetic. (www.cdc.gov)
Hypothyroidism	An estimated 2% to 7.4% of people over the age of 60 have hypothyroidism. (www.postgradmed.com/issues/2003/05_03/mohandas1.htm)
Hyperthyroidism	An estimated 0.5% to 2.3% of people over the age of 60 have hyperthyroidism. (www.postgradmed.com/issues/2003/05_03/mohandas1.htm)
Hyperlipidemia	80% of all deaths from coronary heart disease (CHD) occur in people over the age of 65. In general, elevated cholesterol levels are associated with CHD, although this link is not as strong as it is in younger people. At least 25% of men and 42% of women over the age of 65 have serum cholesterol levels above 240 mg per dL. (www.aafp.org)
Thermoregulatory Disorders	Approximately 600 elderly people die each year in the US from hypothermia. (www.cdc.gov/mmwr/ [Morbidity & Mortality Weekly Report 1/14/00 MMWR]) Hundreds of people over the age of 50 die each year from hyperthermia. (www.nia.nih.gov/)

Diabetes Mellitus (DM)

Diabetes is among the most common chronic illnesses to affect elders over the age of 65 years. Unfortunately, this trend shows no signs of tapering off, largely due to our aging population and the rise of obesity in the United States.

Diabetes Mellitus is classified as Type 1 (previously called “insulin dependent diabetes” and Type 2 (previously called non-insulin dependent diabetes”).

Type 1 DM is caused by an absolute insulin deficiency. This means that the cells in the pancreas that produce insulin are damaged or destroyed and consequently produce little or no insulin. The only treatment for Type 1 DM is insulin.

Type 2 DM is caused by a relative insulin deficiency. The pancreas in Type 2 DM still produces insulin, but it may not be effective or may not be produced in sufficient amounts to control blood sugar. The decreased insulin secretion and insulin resistance eventually lead to hyperglycemia.

Obesity is a major risk factor in the development of Type 2 DM. Treatment includes, diet, exercise and medications that stimulate insulin production. The highest incidence of Type 2 DM occurs in African American women over the age of 75.

Diagnosis

Signs and symptoms that are typically seen with diabetes include:

- excessive thirst (polydipsia)
- hunger (polyphagia)
- excessive urination (polyuria)
- weight loss
- fatigue

The elderly are less likely to complain of weight loss and fatigue, and too often, do not have the classic triad of symptoms including polydipsia, polyphagia and polyuria. This increases the possibility that their diabetes could remain undiscovered until they are comatose.

Additional symptoms that may occur in the elder with diabetes include dehydration, confusion, incontinence or other complications of diabetes such as nephropathy, retinopathy, erectile dysfunction, and foot ulcers.

Diabetes is diagnosed by using any **one** of the following three methods **and confirming the finding on another day**.

1. Acute symptoms (polydipsia, polyuria, polyphagia, weight loss) along with a random (any time of the day, regardless of food) **plasma** blood glucose of 200 mg/dl or higher
2. Fasting (eight hour) plasma blood glucose of 126 mg/dl or higher (normal is less than 100 mg/dl)
3. 2 hour plasma glucose of 200 mg/dl or higher during an Oral Glucose Tolerance Test (OGTT). (normal is less than 140 mg/dl)

Screening for diabetes is recommended every year. This frequent screening is especially important for elders in high-risk groups such as those with hypertension, obesity, a family history of diabetes, an HDL cholesterol 35 mg/dl or less or a triglyceride level greater than 250 mg/dl.

Management

The treatment goal for the elderly with diabetes is the same as for younger patients, that is, keeping the plasma



glucose level as close to normal as possible and avoiding hypoglycemia. The target range for a “close to normal” glucose level of approximately 80-120mg/dl before meals and a glycosylated hemoglobin (HbA_{1c}) level of less than 7%.

The glycosylated hemoglobin (HbA_{1c}) level is a measure of the long-term control of blood glucose, and is determined by the amount of glucose that is bound to hemoglobin in the red blood cell. The normal range is 4 – 6%. The glycosylated hemoglobin (HbA_{1c}) level reflects blood glucose control for the previous 2 –3 months.

Realistically, achieving tight control of the plasma glucose can be considerably more difficult in older adults. A more reasonable goal may be aiming for a glycosylated

hemoglobin (HbA_{1c}) level of less than 8.1%. Chronic illness complicates glucose control for many elders. Avoiding symptoms of hyperglycemia (polyuria, fatigue and weight loss) rather than attaining a normal blood glucose level may be a more practical goal.

Insulin

Insulin injections are required for all patients with Type 1 Diabetes because they cannot make their own insulin.

Insulin injections are usually required from one to four times a day. There are several different types of insulin. Insulins vary in how quickly they start to work and how long they are active in the body. Sometimes, a physician will order two types of insulin mixed together.



Please review the following table for additional information about insulin.

Insulin

Type of insulin	Action	Onset	Peak	Duration	Administration
Lispro Humalog	Rapid	5-15 min.	.5-1.5 hrs.	3-4 hrs.	Immediately before the meal
Aspart NovoLog	Rapid	10-20 min.	40-60 mins.	1-3 hrs.	Immediately before the meal
glulisine Apidra	Rapid	10-20 min.	1-2 hrs.	3-4 hrs.	Immediately before the meal
Regular	Short	.5 -1 hr.	2-3 hrs.	3-6 hrs.	½ hour before the meal
NPH	Intermediate	2-4 hrs.	4-10 hrs.	10-16 hrs.	½ hour before the meal
Glargine Lantus	Long	1-2 hrs.	No Peak	Up to 24 hrs.	Once or twice a day AM and

Type of insulin	Action	Onset	Peak	Duration	Administration
Detemir Levemir	Long	0.8-2 hrs.	3.2-9.3 hrs. depends on dose	Up to 24 hrs.	Once or twice a day AM and PM/HS
70/30	Mixed	½ hr.	Peak 1: 4-6 hrs. Peak 2: 2-3 hrs.	10-16 hrs.	½ hour before the meal
Humalog mix 75/25	Mixed	5-15 min.	Peak 1: 4-10 hrs. Peak 2: 5-15 hrs.	10-16 hrs.	Immediately before the meal
50/50	Mixed	½ hr.	Peak 1: 4-10 hrs. Peak 2: 2-3 hrs.	10-16 hrs.	½ hour before the meal
Novolog Mix 70/30	Mixed	10-20 min.	Peak 1: 4-10 hrs. Peak 2: .6-1hr.	10-16 hrs.	Immediately before the meal

Insulin treatment regimes for elders with Type 1 diabetes are similar to younger diabetic patients. Challenges faced by older adults in the administration of insulin include arthritis and vision problems.

It is crucial to assess elderly patients carefully for their ability to safely administer insulin. Several products are available to assist the elder in insulin administration including:

- Insulin syringe magnifiers
- Pre-filled syringes
- Blood glucose meters that “talk”

Finally, the risk of severe hypoglycemia with insulin administration increases with age. Close monitoring of the elder with insulin dependent diabetes is critical.

Oral Hypoglycemic Agents (OHAs)

Oral hypoglycemic agents are effective in patients with Type II diabetes because they stimulate the secretion of

insulin by the pancreas. Patients with Type 1 diabetes do not respond to OHAs because their pancreas has lost the ability to produce insulin.

Class	Medications	Mechanism of Action
Alpha-glucosidase inhibitors	acarbose Precose® miglitol Glyset®	Medications that delay absorption of glucose from the GI tract Delays digestion of complex carbohydrates Good for elderly with mild diabetes
Biguanides	metformin Glucophage®	Medications that decrease liver glucose production making body cells more sensitive to their own insulin Does not cause hypoglycemia when used independently
Thiazolidinediones	rosiglitazone Avandia® pioglitazone Actos®	Medications that increase cell sensitivity to insulin Does not cause hypoglycemia
Sulfonylureas Meglitinides	glipizide Glucotrol® Glucotrol XL® glyburide Micronase® Diabeta® repaglinide Prandin® nateglinide Starlix® glimepiride amaryl®	Medications that increase insulin production by stimulating the pancreas Acts on the pancreatic Beta cells to secrete insulin May cause hypoglycemia in the elderly

Different oral medications may be combined, or insulin and oral medications may be used together.

Self-management for diabetes include:

- Self-blood glucose monitoring (SMBG).
- A controlled carbohydrate diet (previously called the ADA diet)
- Exercise
- Weight loss
- Medication use will vary depending on the person's needs.

Diabetes is a chronic progressive disease. Over time, even if the patient takes good care of their diabetes, they may need to add another class of diabetes medications.

Diet and Exercise

As with younger patients, diet and exercise are vitally important in managing this chronic illness in the elderly.

Hypoglycemia

The risk of hypoglycemia is greater in the elderly who are cognitively impaired. Older people may not be able to perceive the symptoms of hypoglycemia, even when they have received education.

Additionally, the following factors predispose the elderly to hypoglycemia:

- Poor or erratic nutritional intake
- Changes in mental status that impair the perception or response to hypoglycemia
- Use of multiple medications and noncompliance with medications
- Living situations that may reduce the likelihood of early recognition or intervention for hypoglycemia
- Impaired renal or hepatic metabolism
- Other medical conditions such as dementia, delirium, depression, seizures, heart attack, stroke

As you can see, the management of diabetes in the elderly presents unique challenges, but the rewards of helping an elderly person maintain a healthy lifestyle resulting in an improved quality of life make it worthwhile.

Hypothyroidism

The thyroid gland produces two main hormones, thyroxine (T₄) and triiodothyronine (T₃).

These hormones are responsible for:

- maintaining the rate at which your body uses fats and carbohydrates
- controlling your body temperature
- influencing your heart rate
- regulating the production of protein.

A hormone called calcitonin is also produced by the thyroid gland and regulates the amount of calcium in the blood.

Another hormone associated with the thyroid is thyroid-stimulating hormone (TSH). TSH is produced by the pituitary gland, and stimulates the thyroid to release thyroxine (T₄) and triiodothyronine (T₃).

When the thyroid does not produce enough hormones, hypothyroidism develops. The causes of hypothyroidism include:

- Autoimmune disease (Hashimoto's thyroiditis): Sometimes the body produces antibodies that attack its own tissues. Although it is unclear why this occurs, some possibilities are that a virus or bacteria triggers this response or perhaps a genetic flaw may be involved. This results in a reduction of the hormones that the thyroid produces. When the thyroid is affected, it is called Hashimoto's thyroiditis.
- Treatment for hyperthyroidism: Treatment with radioactive iodine or anti-thyroid medications to reduce thyroid function may result in hypothyroidism.
- Radiation therapy: Radiation used to treat cancers of the head and neck can affect the thyroid gland.
- Thyroid surgery: Removal of the thyroid gland will cause hormone production to cease.
- Medications: Several medications can contribute to hypothyroidism, including lithium.

Hypothyroidism occurs more frequently in the elderly, and unfortunately often remains unnoticed. The reason this diagnosis is often overlooked is because many of the symptoms are often ascribed to "normal aging". In the

elderly, women are more likely to develop hypothyroidism.

Diagnosis

Diagnosis of hypothyroidism in the elderly can be challenging. When compared with younger people, older patients have fewer symptoms, and some of the more common symptoms that occur with hypothyroidism are not present.

In general, the symptoms listed below are indicative of hypothyroidism:

- Increased sensitivity to cold
- Constipation
- Pale, dry skin
- A puffy face
- Hoarse voice
- An elevated blood cholesterol level
- Unexplained weight gain
- Muscle aches, tenderness and stiffness
- Pain, stiffness or swelling in the joints
- Muscle weakness & and unsteady gait
- Heavier than normal menstrual periods
- Depression & lethargy

Symptoms generally associated with hypothyroidism, but often **not** seen in the elderly are cold intolerance and weight gain. Frequently, the symptoms are vague and non-specific in the elderly.

Hypothyroidism is confirmed through blood testing. A low T₄ and elevated TSH are indicative of hypothyroidism. The TSH level is elevated because the pituitary continues to try to stimulate the thyroid gland to produce more hormones.

Management

Hypothyroidism is treated by replacing thyroid hormone with levothyroxine sodium. The average starting dose for an elderly person is in the range of 12.5–50 micrograms/day, which is approximately one-third to one-half the usual dose given to young adults.

In elders with known cardiovascular disease, it is best to start at 12.5 micrograms/day to avoid compromising their cardiovascular status. The half-life of levothyroxine sodium is one week, meaning the effects will linger for at least one week after the medication is stopped.

Commonly accepted advice is to “start low and go slow” when initiating this medication. This will avoid complications related to increased metabolic activity such as:

- Nervousness
- Sweating
- Heat intolerance
- Weight loss
- Palpitations and chest pain

Myxedema Coma

Myxedema coma occurs when there is profound hypothyroidism. Myxedema coma is considered to be life-threatening.

Myxedema coma is caused by:

- Infections such as pneumonia and urinary tract infection
- Medications such as narcotics and tranquilizers
- Stressors such as hospitalization, trauma and surgery

Myxedema coma occurs almost exclusively in people over the age of 60. Eighty percent of cases occur in women.

www.findarticles.com/p/articles/mi_m0FSL/is_5_69/ai_54610899 [Bailes]

Symptoms of myxedema coma include:

- Impaired cognition
- Hypothermia
- Hypotension and bradycardia

Treatment generally occurs in the intensive care unit (ICU) and consists of intravenous administration of levothyroxine and corticosteroids. Supportive care in the

ICU includes cardiac monitoring, airway management and ventilatory support. Hypothermia should not be corrected because vasodilation may occur resulting in worsening hypotension.

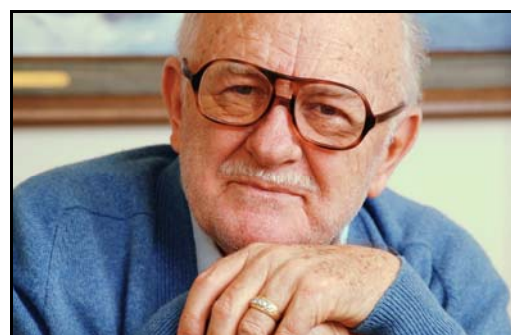
Hyperthyroidism

When the thyroid produces too much of the hormones thyroxine (T₄) and triiodothyronine (T₃), hyperthyroidism develops. The causes of hyperthyroidism include:

- Grave’s disease: The exact cause of Grave’s disease is unknown, but it is suspected to be associated with autoimmune abnormalities. This results in an overproduction of thyroid hormones. In the elderly, this is the most common cause of hyperthyroidism.
- Non-cancerous growths of the thyroid gland or pituitary gland.
- Tumors of the testes or ovaries.
- Inflammation of the thyroid due to viral infections or other causes.
- Ingestion of large amounts of thyroid hormone or excessive iodine.

As with hypothyroidism, the signs and symptoms of hyperthyroidism are often overlooked. It is easy to confuse hyperthyroidism with other, more common diseases in the elderly.

For example, hyperthyroidism in the elderly is frequently associated with irregular heart rhythms and congestive heart failure, and may be mistaken for cardiovascular disease. Other common symptoms associated with hyperthyroidism such as nervousness, weight loss and sweating may also be misinterpreted as a normal part of aging.



Diagnosis

Diagnosis of hyperthyroidism in the elderly can be challenging. Older people may not have the typical symptoms associated with hyperthyroidism.

In general, the symptoms listed below are indicative of hyperthyroidism:

- Weight loss
- Increased appetite
- Increased heart rate
- Muscle weakness
- Exophthalmia
- Nervousness
- Restlessness
- Heat intolerance
- Increased sweating
- Fatigue
- Frequent bowel movements
- Menstrual irregularities in women
- Goiter (visibly enlarged thyroid) may be present

The elderly person may not show the classic symptoms of increased appetite, increased heart rate, exophthalmia and muscle weakness commonly found in younger people.

Symptoms in the elderly are more likely to include atrial fibrillation, congestive heart failure, weight loss and fatigue. The older person is also more likely to be apathetic and depressed.

Laboratory tests for hyperthyroidism usually show a low serum TSH and the T₃ and free T₄ are usually high.

Management

Management of hyperthyroidism differs depending on the etiology of the disease and the severity of symptoms. Treatment options include:

- Antithyroid medications such as propylthiouracil or methimazole block thyroid hormone production.
 - The elderly should receive the lowest effective dose to reduce side effects

such as rashes, thrombocytopenia, and anemia.

- Symptoms generally decrease within 1 - 2 weeks, and thyroid function may return to normal within 2 -3 months.
- Radioactive iodine destroys the thyroid and stops the excess production of hormones.
 - Radioactive iodine is administered by mouth and is generally quite safe.
 - Thyroid hormone output is decreased with in 1 -2 months.
 - Hypothyroidism may occur following treatment, so ongoing monitoring is important.
- Surgery to remove the thyroid is rarely indicated unless the thyroid gland is so large that it causes problems with breathing or swallowing.

Replacement thyroid hormones must be taken for the rest of the person's life when the thyroid is removed by surgery or destroyed with radioactive iodine.

Because some of the symptoms associated with hyperthyroidism can be distressing or even life threatening, beta-blockers like propranolol are used to treat the rapid heart rate, sweating, and anxiety until the treatment takes effect. Sedatives may also be prescribed to reduce nervousness.

Thyroid Crisis

Although thyroid crisis (also known as thyroid storm) occurs infrequently, it can be life-threatening. Untreated hyperthyroidism, infection or trauma can trigger thyroid crisis.

Symptoms of thyroid crisis include fever, tachycardia, atrial fibrillation, dehydration, altered mental status, irritability, delirium or psychosis. Congestive heart failure and pulmonary edema can develop rapidly and lead to death.

Medications used in the management of thyroid crisis include:

- Antithyroid medications such as propylthiouracil or methimazole which block thyroid hormone production
- Steroids which inhibit the conversion of T₄ to T₃

- Beta-blockers like propranolol are used to treat the rapid heart rate, sweating, and anxiety until the treatment takes effect

Thyroid crisis is an emergency. Supportive treatment of the symptoms (such as management of the fever) and administration of oxygen and fluids are crucial.

Hyperlipidemia

Most fat in the body is stored as triglycerides. Hyperlipidemia means an elevated level of lipids (fat) in the blood. The lipids in the blood that we most commonly measure are triglycerides and cholesterol. Elevated levels of cholesterol and triglycerides are associated with an increased risk of coronary heart disease (CHD). CHD is the leading cause of death in people over the age of 65.

Diagnosis

Triglycerides and cholesterol are measured with a simple blood test. These blood tests are performed after fasting overnight.

Triglycerides

Triglycerides come from fats eaten in food or fats made in the body from carbohydrates and protein that were not used immediately by the body for energy.

The following table lists the preferred ranges for triglycerides.

Triglycerides
(American Heart Association)
www.americanheart.org

Desirable	< 150 mg/dL
Normal	< 200 mg/dL
Borderline High	200 – 400 mg/dL
High	400 – 1,000 mg/dL
Very High	>1,000 mg/dL

Cholesterol

Cholesterol performs many useful functions in the body. For example, it is used to form cell membranes and is a crucial component of some hormones.

When the cholesterol level is too high though, it can slowly build up on the walls of the arteries. Eventually, it combines with other substances, and plaque forms, which can occlude the blood flow to organs such as the heart and brain.

Low-density lipoprotein (LDL) cholesterol is the major component of cholesterol, and high levels are associated with an increased risk of heart disease. LDL is often called “bad cholesterol”.

High-density lipoprotein (HDL) is considered to be the “good cholesterol” because it carries cholesterol away from the arteries to the liver for excretion.

The tables below list the guidelines for total cholesterol, LDL and HDL cholesterol levels.

Total Cholesterol
(American Heart Association)
www.americanheart.org

Desirable	< 200 mg/dL
Borderline High	200 – 239 mg/dL
High	>240 mg/dL

LDL Cholesterol
(American Heart Association)
www.americanheart.org

Intermediate Risk	130 - 159 mg/dL
Moderately High Risk	160 – 189 mg/dL
High Risk	>190 mg/dL

HDL Cholesterol
(National Cholesterol Education Program Guidelines)
www.nhlbi.nih.gov/chd

Lower risk of CHD	> or = to 60mg/dL
Treatment may be recommended	< 40 mg/dL

Management and Prevention

Lowering triglycerides and cholesterol has been shown to reduce both heart disease and strokes in the elderly. The good news is that a combination of diet, weight loss, exercise and medications can positively impact health.

Diet

Dietary guidelines recommended by the American Heart Association to reduce triglyceride and cholesterol levels include the following:

- Reduce the amount of saturated fat and cholesterol in the diet
- Substitute monounsaturated and polyunsaturated fats (such as canola oil and olive oil) for saturated fats (such as coconut and palm oil)
- Substitute fish high in omega-3 fatty acids (such as salmon, lake trout and tuna) and lean meats such as poultry without the skin for meats high in saturated fat like hamburger
- Substitute low fat dairy products for dairy products higher in fat
- Include plenty of fruit, vegetables, whole grain bread, cereals, and legumes (peas, beans and lentils)
- Keep in mind substituting carbohydrates for fats may raise triglyceride level and may decrease HDL (“good”) cholesterol
- Maintain a healthy weight by reducing calories as necessary

Exercise

Thirty minutes of exercise a day is recommended by the American Heart Association to reduce the level of triglycerides and cholesterol.

Tobacco

Tobacco use is one of the risk factors for coronary heart disease that can be controlled. Smoking contributes to coronary heart disease by reducing the HDL (good cholesterol) level and increasing the tendency of the blood to clot.

Alcohol

Alcohol should be consumed in moderation. There is some evidence that alcohol has a protective factor against heart disease, however the risks are considerable. Keep

in mind that there are numerous other risks associated with alcohol consumption including alcoholism, high blood pressure, obesity and stroke.

Medications

There are a variety of medications available to lower triglyceride and cholesterol levels.

“Statins” are among the most effective at lowering triglycerides and total and HDL cholesterol when diet and exercise are not effective. These medications decrease the body’s production of cholesterol and can reduce the total and LDL cholesterol level by as much as 20-60%. There are few side effects with these medications.

“Statin” Medications

Generic Name	Trade Name
lovastatin	Advicor®, Mevacor®, & Altacor®
fluvastatin	Lescol®
atorvastatin	Lipitor®
pravastatin	Pravachol® and Pravigard®
simvastatin	Zocor®



**Other medications used to
lower cholesterol and triglycerides**

Generic Name	Trade Name	Mechanism of Action
Clofibrate	Atromid-S®	Raises the HDL cholesterol levels and lowers triglyceride levels
Gemfibrozil	Lopid®	Raises HDL cholesterol levels
Nicotinic Acid		Works in the liver by affecting the production of blood fats Lowers triglycerides and LDL cholesterol Raises HDL ("good") cholesterol
Resins Cholestyramine	Questran® Prevalite® Lo-Cholest®	Works in the intestines to promote increased disposal of cholesterol
Colestipol	Colestid®	
Colesevelam	WelChol®	

In general, treatment for high cholesterol and triglycerides requires a multi-pronged approach, and is monitored closely by the physician.

Thermoregulatory Disorders: Hypothermia

With the arrival of cooler temperatures in the fall and winter, the elderly are at a greater risk for hypothermia. As we age, the body is less effective at regulating and maintaining body temperature.

Several factors put the elderly at a greater risk for hypothermia:

- Decreased heat production due to immobility, hypothyroidism and malnutrition
- Increased heat loss due to loss of subcutaneous fat
- Sedatives and tranquilizers in the elderly can impair judgement

- Poorly heated homes (<65°F can be associated with the development of hypothermia in an elderly person)

Diagnosis

A body temperature of less than 96°F is considered to be hypothermia. The National Institutes of Health recommend looking for the “umbles” — *stumbles, mumbles, fumbles, and grumbles* as an early indicator of hypothermia. These signs indicate how cold is affecting a person’s muscles and nerves.

The symptoms of hypothermia vary depending on core body temperature. Listed in the table below are the signs and symptoms of hypothermia.

Signs and Symptoms of Hypothermia

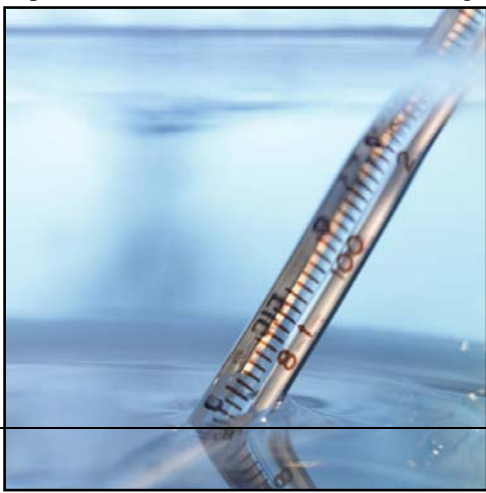
	Core Body Temperature	Symptoms
Mild Hypothermia	32 - 35°C 90 - 95°F	<ul style="list-style-type: none"> • Fatigue • Weakness • Slurred speech • Slowed gait • Confusion • Cool skin • Apathy • Muscle weakness • Shivering may or may not occur in the elderly

	Core Body Temperature	Symptoms
Moderate Hypothermia	28 - 32°C 82 - 90°F	<ul style="list-style-type: none"> • Acute confusion, progressing to unconsciousness • Cyanosis • Sinus bradycardia, atrial and ventricular dysrhythmias • Pulse, respirations and blood pressure decrease • Muscle rigidity • Slowed reflexes • Poorly reactive pupils
Severe Hypothermia	< 28°C < 82°F	<ul style="list-style-type: none"> • Muscle rigidity • Unresponsiveness • Fixed pupils • Apnea • Ventricular fibrillation • Asystole • Cardiorespiratory arrest

Management

If you suspect that an elderly person is hypothermic, you should check their temperature. If their body temperature is less than 96°F, you should call for emergency help. Even though a body temperature of 96°F doesn't seem all that low, it puts the elderly person at risk of developing dysrhythmias.

Until help arrives, keep the elderly person warm and dry. Wrap the person in blankets, towels or coats. In general,



the focus in the treatment of hypothermia is on preventing further heat loss and to start re-warming the elderly person.

The following guidelines are recommended by the American Heart Association for treatment of hypothermia.

Treatment of Hypothermia (American Heart Association) www.americanheart.org

Mild (>34°C [>93.2°F])

Warm the patient with warm blankets and a warm environment.

Moderate (30°C to 34°C [86°F to 93.2°F])

In this situation, more vigorous methods need to be used including: heating blankets, warmed IV fluids and warmed forced air.

Severe (<30°C [86°F])

This is generally considered a medical emergency, and is commonly associated with cardiac arrest.

- At this point invasive re-warming techniques are necessary, including: peritoneal lavage with warmed fluid, esophageal re-warming tubes, cardiopulmonary bypass and extracorporeal circulation.
- If the patient is in cardiac arrest, basic cardiac life support needs to be initiated. One notable difference in managing hypothermic patients with cardiac arrest is that these patients may benefit from prolonged CPR and aggressive re-warming techniques.
- Some health care professionals believe that a victim of hypothermia is not dead, until they are "warm and dead". Thus, prolonged CPR and aggressive re-warming techniques are necessary to make sure there is no hope for recovery.

Prevention

Education of the elder and their family are crucial in prevention of hypothermia. Key points to emphasize include:

- Maintain room of 65°F or more
- Dress in numerous loose layers
- Limit exposure to the cold
- Wear a hat or a scarf to minimize heat loss
- Eat well because a layer of fat reduces heat loss
- Avoid alcohol because it increases heat loss by causing peripheral vasodilation
- Avoid caffeine because it may cause vasoconstriction of the extremities
- Cover the elderly person during a bath, and dry completely afterward
- Encourage exercise to help the person generate heat from muscle activity

The body is less effective at regulating and maintaining body temperature as we age. Whether the elder is living in their own home, or in a long term care facility, education and awareness are key components in the prevention of hypothermia.

Thermoregulatory Disorders: Heat-Related Illnesses

The change of seasons brings with it an increase in heat-related illness when the heat and humidity begin to rise. Just as with hypothermia, the elderly are at an increased risk for heat-related illnesses because they have a decreased ability to maintain a steady body temperature.

Several factors contribute to an older person's increased susceptibility to developing heat-related illnesses.

- Lack of air conditioning in the home
- Decreased sensitivity to changes in temperature
- The ability to sweat decreases with age, resulting in a diminished ability for the body to cool itself
- Chronic diseases such as congestive heart failure, diabetes and alcoholism
- Tricyclic antidepressants (anticholinergics) may decrease the body's ability to sweat
- Beta-blockers may depress myocardial function due to their negative inotropic action and this may lead to cardiovascular compromise

- Antihistamines can inhibit sweating
- Diuretics may cause hypovolemia

Diagnosis

The two most commonly occurring heat-related illnesses in the elderly are heat exhaustion and hyperthermia, also called heat stroke.

Heat exhaustion

Heat exhaustion is usually caused by exposure to heat, coupled with an excessive loss of body water and electrolytes.

The symptoms of heat exhaustion, especially in the elderly, are often vague and non-specific. In fact, the core body temperature is usually less than 102.2°F (39°C), and may even be in the normal range.

Signs of heat exhaustion include:

- Skin: cool, clammy, diaphoresis
- Temperature: slightly elevated or normal
- Pulse: weak and thready
- Respirations: shallow
- Thirst (this is not always present in the elderly person)
- Weakness, dizziness, feeling faint
- Anorexia, nausea, vomiting

Care of Heat Exhaustion

The main cause of heat-related illness is exposure to heat, and so one of the most important interventions is to move the affected person to a cool area and loosen their clothing.

Because the other primary cause of heat exhaustion is fluid and electrolyte depletion, it is important to have the elderly person drink fluids. Juice and liquids such as Gatorade® are recommended. If the person has a decreased level of consciousness and is unable to drink, they may require intravenous replacement of fluid and electrolytes.

Usually the interventions listed above are successful, and the person recovers without further problems.

Hyperthermia (heat stroke)

Hyperthermia is one of the most severe of the heat-related illnesses and is considered to be a life-threatening. The mortality rate is very high, and immediate emergency treatment is needed.

Signs of hyperthermia (heat stroke) include: (www.nlm.nih.gov)

- Skin: hot, dry, no diaphoresis (not sweating, despite the heat)
- Temperature: high (over 104° F [40°C])
- Pulse: bounding
- Respirations: dyspneic
- Fainting, possibly the first sign,
- A change in behavior — confusion, being grouchy, acting strangely, or staggering
- Acting delirious, or being in a coma

How do the symptoms of heat exhaustion and hyperthermia compare?

Heat Exhaustion	Hyperthermia
Skin: cool, clammy, diaphoresis	Skin: hot, dry, no diaphoresis (not sweating, despite the heat)
Temperature: slightly elevated or normal	Temperature: high (over 104° F [40°C])
Pulse: weak and thready	Pulse: bounding
Respirations: shallow	Respirations: dyspneic

Management

Management of heat-related illnesses ranges from the simple to the complex, depending on whether it is heat exhaustion or hyperthermia. In fact, early treatment of heat exhaustion can stop the progression to hyperthermia. Anti-pyretics are not effective in the management of heat-related illnesses.

Care of Hyperthermia

Hyperthermia needs to be managed aggressively and quickly before permanent damage occurs.

The primary goal is to lower the core body temperature. Tissue damage to structures such as the brain, heart and liver occur when the core temperature reaches 109° F (43°C).

Remember, hyperthermia is a medical emergency. One of the most important things to do immediately is to check and protect the airway. After the airway is secured, lowering the body temperature is crucial.

Cooling the patient can be accomplished by using one of the following techniques:

- hypothermic blanket
- wrapping the patient in wet, ice filled towels
- ice water immersion

Lowering the body temperature rapidly is important. Ideally, the temperature should be brought down to 102° F within the first hour of treatment. However, if the core body temperature is lowered too quickly, shivering can occur, and the temperature will not decrease. Another complication of lowering the body temperature too quickly is that hypothermia can develop.

Hyperthermia is a medical emergency and treatment is generally administered by emergency personnel or in the hospital.

Prevention

It is much better to prevent heat-related illnesses than to treat them after they occur. The following recommendations are from the National Institute on Aging:

- Drink plenty of fluids, avoid caffeine and alcohol.
- If the elder's home does not have air conditioning try to minimize the temperature in the home by covering windows that are in direct sunlight during the day, and opening the windows to provide cross-ventilation at night. Recommend that the elder spend at least 2 hours during the hottest part of the day in an air conditioned environment such as a senior center or shopping mall.

- Social services may be able to provide resources for the elderly to obtain an air conditioner.
- Recommend that the elderly person does not exercise when it is hot.
- Teach patients and families the early signs and symptoms of heat-related illness and what to do if they develop.

As you can see, hyperthermia is a dangerous illness and carries with it a high mortality rate, especially in the elderly. It is much better to prevent hyperthermia than to treat it in the elderly.

Summary

Metabolic and endocrine problems are among the more challenging and complex difficulties faced by the elderly. In this home study, you learned about the normal changes of aging in the endocrine system; the diseases that affect more of the elderly population; and the differences in the assessment and management of the elder experiencing metabolic and endocrine problems.

Recommended Reading

1. American Nurses Association. *Scope and Standards of Gerontological Nursing Practice*, 2nd ed. Washington, DC: ANA, 2001.
2. Bailes, B.K. *Hyperthyroidism in Elderly Patients*. AORN Journal. 69(1): 254-256, 258. 1999.
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6. Eliopoulos C. *Manual of Gerontologic Nursing*, 5th ed. Philadelphia: Lippincott, 2001.
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9. Lueckenotte A. *Gerontologic Nursing*, 2nd ed. St. Louis: Mosby, 2000.
10. Maas ML, Buckwalter KC, Hardy MA et al. (eds.). *Nursing Care of Older Adults: Diagnosis,*

Outcomes, and Interventions. St. Louis: Mosby, 2001.

11. Mohandas, R., Gupta, K.L. *Managing Thyroid Dysfunction in the Elderly*. Postgraduate Medicine. 113(5): 54-68,100. 2003.
12. Wallace, J.I. *Management of Diabetes in the Elderly*. Clinical Diabetes. January, 1999.
13. <http://www.nlm.nih.gov>
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15. <http://www.nyu.edu>
16. www.mayoclinic.com
17. www.circ.ahajournals.org
18. www.americanheart.org
19. www.patients.uptodate.com
20. www.cdc.gov/diabetes
21. www.nia.nih.gov/HealthInformation/Publications/
22. www.aafp.org
23. www.nhlbi.nih.gov/chd

Directions for Submitting Your Post Test for Contact Hours

To obtain a certificate of completion for this home study program, please complete the post-test and evaluation on the next few pages. The date on your certificate of completion will be the date that your home study is received. **Any materials received with a postmark after the expiration will be discarded.**

HealthEast, HCMC, or MVAMC Employees

If you are an employee of HealthEast, HCMC, or MVAMC, you may send the post-test and evaluation to TCHP for processing. Your post-test will be returned to you through your hospital. It cannot be mailed to your home.

Paid Participants

If you are not an employee of one of the TCHP hospitals, please send the post-test and evaluation to TCHP with a check for \$12.00. Please make check payable to **TCHP Education** and mail to:

TCHP Education Consortium
Capitol Office Building
525 Park Street, Suite 120
St. Paul, MN 55103

Your post-test will be returned to you with the certificate of completion.

Insulin Reference Guide

Type of insulin	Appearance	Action	Onset	Peak	Duration	Mixable	Administration
lispro/Humalog	Clear	Rapid	5-15 min.	.5-1.5 hrs.	3-4 hrs.	Yes, only with NPH	Immediately before the meal
aspart/NovoLog	Clear	Rapid	10-20 min.	40-60 mins.	1-3 hrs.	Yes, only with NPH	Immediately before the meal
glulisine /Apidra	Clear	Rapid	10-20 min.	1-2 hrs.	3-4 hrs.	Yes, only with NPH	Immediately before the meal
Regular	Clear	Short	.5 -1 hr.	2-3 hrs.	3-6 hrs.	Yes	½ hour before the meal
NPH	Cloudy	Intermediate	2-4 hrs.	4-10 hrs.	10-16 hrs.	Yes	½ hour before the meal
glargine/Lantus	Clear	Long	1-2 hrs.	No Peak	Up to 24 hrs.	No	Once or twice a day AM and PM/HS
detemir/Levemir	Clear	Long	0.8-2 hrs.	3.2-9.3 hrs. Dose dependent	Up to 24 hrs.	No	Once or twice a day AM and PM/HS
70/30	Cloudy	Mixed	½ hr.	Peak 1: 4-6 hrs. Peak 2: 2-3 hrs.	10-16 hrs.	No	½ hour before the meal
Humalog mix 75/25	Cloudy	Mixed	5-15 min.	Peak 1: 4-10 hrs. Peak 2: .5-1.5hrs.	10-16 hrs.	No	Immediately before the meal
50/50	Cloudy	Mixed	½ hr.	Peak 1: 4-10 hrs. Peak 2: 2-3 hrs.	10-16 hrs.	No	½ hour before the meal
Novolog Mix 70/30	Cloudy	Mixed	10-20 min.	Peak 1: 4-10 hrs. Peak 2: .6-1 hrs.	10-16 hrs.	No	Immediately before the meal

Diabetes Oral Medication Reference Guide

	Generic Drug Name	Brand Name	Main Site of Action	Timing with Meals	Frequency	Causes Hypoglycemia
Sulfonylureas	glipizide	Glucotrol®	Pancreas	½ hour before meals	1-2x / day	Yes
	glipizide (long-acting)	Glucotrol XL®	Pancreas	Take with 1 st meal	Usually 1x / day, may be given 2x / day	Yes
	glyburide	DiaBeta, Micronase®	Pancreas	Take with meal	1-2x / day	Yes
	glimepiride	Amaryl®	Pancreas	Take with 1 st meal	1x / day	Yes
Meglitinids	repaglinide	Prandin®	Pancreas	Take immediately before main meals	3x / day	Yes
	nateglinide	Starlix®	Pancreas	Take immediately before main meals	3x / day	Yes
Biguanides	metformin	Glucophage®	Liver	Take with meal	1-3x / day	No
	metformin (long-acting)	Glucophage XR®	Liver	Take with 1 st meal	Usually 1x / day, may be given 2x / day	No
Alpha-glucosidase inhibitors	acarbose	Precose®	Intestines	Take with 1 st bite of each meal	3x / day	No – treat hypoglycemia with glucose tablets or gel
	miglitol	Glyset®	Intestines	Take with 1 st bite of each meal	3x / day	No – treat hypoglycemia with glucose tablets or gel
Thiazolidinediones	pioglitazone	Actos®	Muscle	Take with meal	1x / day	No
	rosiglitazone	Avandia®	Muscle	Take with meal	1-2x / day	No
Combination	metformin + glyburide	Glucovance®	Liver + Pancreas	Take with meal	1-2x / day	Yes
	metformin + rosiglitazone	Avandamet®	Liver + Muscle	Take with meal	1-2x / day	No
	metformin + glipizide	Metaglip®	Liver + Pancreas	Take with meal	1-2x / day	Yes
	metformin + pioglitazone	Actoplus Met®	Muscle + Liver	Take with food	1-2x / day	No

Metabolic and Endocrine Issues in ElderCare Post-Test

Please print all information clearly and sign the verification statement:

Name _____
(please print legal name above)

Birth date (required)

Format: 01/03/1999

M	M	D	D	Y	Y	Y	Y

For HealthEast, HCMC, or MVAMC, employees only:

Hospital _____ Unit _____

Personal verification of successful completion of this educational activity (required):

I verify that I have read this home study and have completed the post-test and evaluation.

Signature

- 1) In general, endocrine function is decreased in the elderly, resulting in the gradual elevation of the fasting glucose level after age 50.
 - a) True
 - b) False
- 2) The glycosylated hemoglobin (HbA_{1c}) level reflects blood glucose control for the previous:
 - a) 2 - 3 days
 - b) 2 - 3 months
 - c) 2 - 3 years
 - d) None of the above
- 3) Which of the following factors predispose the elderly to hypoglycemia?
 - a) Poor or erratic nutritional intake
 - b) Changes in mental status that impair the perception or response to hypoglycemia
 - c) Use of multiple medications and noncompliance with medications
 - d) Living situations that may reduce the likelihood of early recognition or intervention for hypoglycemia
 - e) All of the above

- 4) Symptoms generally associated with hypothyroidism, but often **not** seen in the elderly are:
 - a) Cold intolerance
 - b) Muscle aches, tenderness and stiffness
 - c) Depression
 - d) Weight gain
 - e) a & d
- 5) It is easy to confuse hyperthyroidism with other, more common diseases in the elderly.
 - a) True
 - b) False
- 6) The American Heart Association guidelines for desirable level of total cholesterol is:
 - a) < 150 mg/dL
 - b) < 200 mg/dL
 - c) 200 – 239 mg/dL
 - d) > 240 mg/dL
 - e) None of the above
- 7) The following guidelines are recommended by the American Heart Association for treatment of mild hypothermia (>34°C [>93.2°F]):
 - a) Peritoneal lavage with warmed fluid
 - b) Warm the patient with warm blankets and a warm environment
 - c) Warmed IV fluids
 - d) Cardiopulmonary bypass and extracorporeal circulation
- 8) One factor that contributes to an older person's increased susceptibility to developing heat-related illnesses is a decreased sensitivity to changes in temperature.
 - a) True
 - b) False
- 9) Symptoms of hyperthermia include:
 - a) Weak and thready pulse
 - b) Skin is cool, clammy and diaphoretic
 - c) Shallow respirations
 - d) Skin is hot, dry, no diaphoresis (not sweating, despite the heat)

Expiration date: The last day that post tests will be accepted for this edition is **December 31, 2017**—your envelope must be postmarked on or before that day.

Evaluation: Metabolic and Endocrine Issues in ElderCare

Please complete the evaluation form below by placing an "X" in the box that best fits your evaluation of this educational activity. Completion of this form is required to successfully complete the activity and be awarded contact hours.

At the end of this home study program, I am able to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Describe common metabolic/endocrine changes and pathophysiology related to aging.					
2. Formulate a plan for assessing and managing the elderly patient with metabolic and endocrine disease.					
3. The teaching / learning resources were effective. <i>If not, please comment:</i>					

The following were disclosed in writing prior to, or at the start of, this educational activity (please refer to the first 2 pages of the booklet).		
	Yes	No
4. Notice of requirements for successful completion, including purpose and objectives		
5. Conflict of interest		
6. Disclosure of relevant financial relationships and mechanism to identify and resolve conflicts of interest		
7. Sponsorship or commercial support		
8. Non-endorsement of products		
9. Off-label use		
10. Expiration Date for Awarding Contact Hours		
11. Did you, as a participant, notice any bias in this educational activity that was not previously disclosed? <i>If yes, please describe the nature of the bias:</i>		

12. How long did it take you to read this home study and complete the post test and evaluation:

_____ hours and _____ minutes.

13. Did you feel that the number of contact hours offered for this educational activity was appropriate for the amount of time you spent on it?

___ Yes

___ No, more contact hours should have been offered

___ No, fewer contact hours should have been offered.

Expiration date: December 31, 2017
