INTERNATIONAL SPINAL CORD INJURY DATA SETS

ENDOCRINE AND METABOLIC EXTENDED DATA SET (Version 1.0)

The working-group consists of:

William A. Bauman, chair, is a member of American Spinal Injury Association (ASIA). Jill M. Wecht, was an author on the International Standards to Document Remaining Autonomic Function after SCI and is a member of ASIA. Fin Biering-Sørensen, chair of the International Spinal Cord Injury Data Sets Committee under the International Spinal Cord Society (ISCoS) and ASIA, is a member of both ASIA and ISCoS.

The purpose of the International Spinal Cord Injury (SCI) Endocrine and Metabolic Extended Data Set is to standardize the collection and reporting of information on endocrine & metabolic function in accordance with the purpose and vision of the International SCI Data Sets 1.

The majority of persons with SCI develop one or more endocrine and/or metabolic disorders 2-15. Onset, diagnosis, and treatment of these endocrine and metabolic disorders may impact the quality of life and longevity of persons with SCI. Head trauma associated with acute SCI may result in selective or global pituitary-hypothalamic insufficiency 5,12,15-19; bilateral abdominal trauma may be associated with adrenal insufficiency 20. Immobilization is generally associated with rapid and progressive bone mineral loss, often resulting in marked osteoporosis of the skeleton below the level of lesion 6,8,21-27. With acute injury, there is atrophy of paralyzed muscle and the occurrence of absolute or relative adiposity 28-31. (Due to inactivity and adverse body compositional changes, individuals may develop abnormalities in carbohydrate and lipid metabolism that predispose to cardiovascular atherogenesis 2,4,32-35. Abnormalities of the gonads (e.g., acute and chronic testicular dysfunction in males and acute ovarian dysfunction in females) have been reported to occur 3,9,13,14. Having SCI does not protect against having other fairly prevalent endocrine abnormalities, such as autoimmune thyroid dysfunction, especially in women, which may be precipitated by an acute stressful event, or traumatic events distant to the acute injury 36. Hypotension with upright posture occurs frequently in persons with higher cord lesions due to a deficient or absent peripheral release of norepinephrine to vascular challenge and secondary reliance upon the angiotensin-renin-aldosterone axis to maintain vascular integrity 10,11,37-39. When these specific disorders are clinically suspected specific components of this data set may be utilized to assist in diagnosis and treatment.

The information collected in this International SCI Endocrine and Metabolic Extended Data Set will generally be used in connection with data in the International SCI Core Data Set 40, which includes information on date of birth and injury, gender, the cause of spinal cord lesion, and neurologic status. It will be used together with International SCI Endocrine and Metabolic Basic Data Set 41,42. In addition, it may be used together with other relevant International SCI Basic or Extended Data Sets, when appropriate and relevant. As an example, fragile fractures in SCI are described in the International SCI Musculoskeletal Basic Data Set 43 and, therefore, this item was not included in the present dataset when collecting other variables related to osteoporosis of immobilization.
The diagnosis of endocrine and metabolic disorders has been clearly established in the general population. The direct application of this knowledge to persons with SCI can be accomplished by standard examination and laboratory determinations. The aim of this International SCI Endocrinology and Metabolism Extended Data Set is to present a standardized format for the collection and reporting of information on endocrine and metabolic disorders which have been identified in clinical practice and, after being collected, for possible research purposes. It may not be necessary in a particular patient to collect all variables provided in this data set; however, when a specific clinical issue, for example, hyperthyroidism is being assessed, it is recommended that all variables that are related to thyroid disease be collected. To permit valid comparison of information obtained, it is crucial that data be collected in a uniform manner. For this reason, each variable and each response category within each variable has specifically been defined in a way that is designed to promote the collection and reporting of comparable data. Use of a standard format is essential for combining data from multiple investigators and locations. Various formats and coding schemes may be equally effective and could be used in individual studies or by agreement of the collaborating investigators. The International SCI Endocrinology and Metabolism Extended Data Set will make it possible to evaluate and compare results from various published studies on endocrine and metabolic dysfunction after SCI, as an objective of the International SCI Data Sets.

The etiology of a spinal cord lesion may be traumatic or non-traumatic. All lesions to the spinal cord, conus medullaris, and cauda equina are included in the present context.

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Acknowledgement:
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General remark regarding date of data collection/performing the test

**DESCRIPTION:** For each set of variables in this dataset the date of data collection/performing the test is required.

**CODE**
- YYYYMMDD (Year – Month – Day)
- Unknown

**COMMENTS:** Because the collection of data on endocrine and metabolic conditions may be performed at any time following the spinal cord lesion, the date of data collection is imperative for computing the time that has lapsed after the initial spinal cord lesion. This will permit the information obtained to be related to other data collected on the same individual at various time points.

**CARBOHYDRATE METABOLISM**

**CODE**
- YYYYMMDD (Year – Month – Day)
- Unknown

**VARIABLE NAME:** Fasting plasma glucose:

**DESCRIPTION:** This variable will assess the ability to maintain fasting glucose homeostasis

**CODES:** Fasting plasma glucose in mmol/L

**COMMENTS:** *Classifications:* Diabetes mellitus is diagnosed as a fasting glucose value $\geq 7$ mmol/L (126 mg/dL); impaired glucose tolerance is defined as a fasting glucose value 5.6–6.9 mmol/L (100–125 mg/dL)\textsuperscript{44,45}. An elevated fasting plasma glucose concentration would permit diagnosis of a disorder of oral carbohydrate tolerance. There is an increased prevalence of abnormalities in carbohydrate tolerance in persons with chronic SCI\textsuperscript{4,28}.

**VARIABLE NAME:** Oral carbohydrate tolerance – 2 hour plasma glucose:

**DESCRIPTION:** This variable will assess the ability to handle an oral glucose load.
Disorders of oral carbohydrate tolerance have been reported to be increased in persons with chronic SCI. Because disorders of oral carbohydrate tolerance often will remain occult unless provocative testing is performed, and because those with SCI have a increased prevalence of impaired glucose tolerance and diabetes mellitus, it is recommended that practitioners perform oral glucose tolerance testing at least once every 5 to 10 years, or if there is suspicion of deterioration in carbohydrate tolerance. Refer to the classification of The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus 2003.

**VARIABLE NAME:** Oral glucose tolerance test (OGTT) – diagnostic classification.

**DESCRIPTION:** This variable will assess the ability to handle an oral glucose load.

**CODES:** Normal; Impaired Glucose Tolerance; Diabetes Mellitus

**COMMENTS:**

Classifications: Diabetes mellitus is diagnosed as a stimulated value (2 hours plasma glucose) $\geq 11.1$ mmol/L (200 mg/dL); impaired glucose tolerance is defined as a stimulated value (2 hours plasma glucose) 7.8-10.9 mmol/L (140-199 mg/dL) The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. 2003. Impaired glucose tolerance and type 2 diabetes mellitus are increased in persons with chronic SCI. Any disorder associated with hyperglycemia would be expected to increase the risk of cardiovascular disease. Diabetes mellitus is a cardiovascular risk equivalent in stratifying risk for appropriate therapeutic intervention; Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults.

**VARIABLE NAME:** Fasting plasma insulin

**DESCRIPTION:** This variable will assess basal insulin reserve and peripheral insulin sensitivity.

**CODES:** Fasting plasma insulin in pmol/L

**COMMENTS:**

Normal range: fasting 35-105 pmol/L. As a consequence of inactivity and adverse body compositional changes, persons with SCI have been found to be insulin resistant. The fasting plasma insulin level has been found to correlate with peripheral insulin sensitivity.
VARIABLE NAME: Oral carbohydrate tolerance – 2 hour plasma insulin
DESCRIPTION: This variable will assess insulin reserve and peripheral insulin sensitivity.
CODES: 2 hour plasma insulin in pmol/L
COMMENTS: Normal range: stimulated <1076 pmol/L. Determinants of insulin resistance are strongly present in persons with SCI: decreased activity, decreased muscle mass, and increased absolute or relative adiposity. A strong correlation exists between the insulin response to an oral glucose load and peripheral insulin sensitivity/resistance 47.

VARIABLE NAME: Hemoglobin A1c (HgA1c)
DESCRIPTION: This variable documents average glycemic control.
CODES: HgA1c in %
COMMENTS: Normal value: <6.5%. The integrated plasma glucose as reflected in the HgA1c value provides valuable information as to average carbohydrate handling.

CALCIUM & BONE METABOLISM

CODE YYYYMMDD (Year – Month – Day)
Unknown

VARIABLE NAME: Plasma/Serum calcium concentration
DESCRIPTION: This variable documents abnormality in circulating total calcium level.
CODES: Plasma/Serum calcium concentration in mmol/L
COMMENTS: Normal range: 2.2-2.6 mmol/L. Hypercalcemia during acute SCI may occur in individuals who have renal insufficiency (e.g., dehydration, acute or chronic renal disease) and/or high bone turnover rates (e.g., children, multiple bone fractures, Paget’s disease, or other conditions) 24, 48, but hypercalcemia may also
Infrequently occur in adults with SCI without any predisposing conditions. Osteoporosis may result from paralysis and immobilization, but the skeletal loss may be made worse by a concomitant occult disorder in calcium metabolism. If the calcium concentration is elevated in an adult without a known pre-existing condition, it would suggest that another abnormality in calcium metabolism is present that may make the bone loss after SCI more pronounced. A high calcium concentration may suggest hyperparathyroidism and PTH-independent conditions (e.g., malignancy, vitamin D intoxication, granulomatous diseases, thiazides, etc.), whereas a low calcium value may suggest poor dietary intake of calcium and/or vitamin D deficiency.

### VARIABLE NAME: Plasma ionized calcium concentration

### DESCRIPTION:
This variable documents abnormality in circulating ionized calcium level.

### CODES:
Plasma ionized calcium concentration in mmol/L

### COMMENTS:
*Normal range:* 1.1-1.4 mmol/L. The free cation concentration in plasma is referred to as “ionized calcium.” Calcium is present in the blood in the protein-bound and free forms, which together comprise the total plasma calcium concentration. The total plasma calcium concentration may vary dependent predominantly upon the serum albumin concentration. Because the serum albumin concentration may vary because of acute or chronic illness, the plasma ionized calcium concentration provides a direct determination of the bioactive plasma calcium concentration. When there is uncertainty in the biologically active calcium concentration, often due to derangements in protein binding, it is recommended to perform a plasma ionized calcium concentration. Please refer to additional comments provided above for disorders in the plasma total calcium concentration that may occur in persons with SCI.

### VARIABLE NAME: 24-hour urinary calcium excretion

### DESCRIPTION:
This variable documents renal excretion of calcium.

### CODES:
Urine calcium in mmol /24 hours

### COMMENTS:
*Normal range:* <7.3 mmol/kg body weight. When the level of the plasma free calcium concentration is elevated or depressed, performing a 24-hour urinary calcium excretion will assist to clarify
the clinical picture, and also provide information on the magnitude of the disorder. For example, shortly after SCI, there is an increase in bone resorption, which elevates the plasma ionized calcium concentration. This will result in increased renal excretion of calcium, with the magnitude of calcium excretion directly related to the degree of bone resorption. Hypercalciuria may be associated with renal lithiasis 23, 25, 26.

**VARIABLE NAME:** Spot urine calcium to creatinine ratio (Ca/Cr)

**DESCRIPTION:** This variable documents renal excretion of calcium.

**CODES:** Urine calcium (mmol) to creatinine (µmol/L) ratio

**COMMENTS:** Normal range: <0.057 mmol/µmol/L. Please refer to the comments on the variable entitled 24 hour urinary calcium excretion. In certain populations, such as children, a spot urine Ca/Cr is often more practical to obtain than a 24-hour urine collection for calcium measurement. To exclude absorptive hypercalciemia, it is recommended that the spot urine Ca/Cr be performed after an oral calcium load. Although a linear correlation has been reported between a fasting first-morning spot urine Ca/Cr and 24-hour urine collection for calcium measurement 50, other reports have suggested a weak correlation between fasting or non-fasting spot urine Ca/Cr collection and 24-hour urine collection for calcium measurement 51, 52. As such, a 24-hour urinary calcium excretion is the preferred test to more definitively establish the diagnosis of hypercalciuria.

**VARIABLE NAME:** Serum vitamin 25-hydroxyvitamin D (25-OH D) level

**DESCRIPTION:** This variable documents low or normal body stores of vitamin D

**CODES:** 25-OH D level in nmol/L

**COMMENTS:** Normal range: 50-150 nmol/L. Persons with SCI have been identified to have a greater prevalence of being vitamin D deficient 6. Measuring the level of 25-OH D, the storage form of vitamin D, is accepted as the routine manner to exclude a vitamin D deficient state. A deficiency of vitamin D would reduce gut absorption of calcium and predispose to osteoporosis 53. Adequate intake and circulating levels of vitamin D are important to maintain skeletal integrity 6, 54. There exists controversy as to the acceptable lower limit of vitamin D concentration. The Thirteenth Workshop Consensus for Vitamin D Nutritional Guidelines 55 and the Institute
of Medicine\textsuperscript{56} recommended a serum 25-OH D concentration of $\geq 50$ nmol/L; this value for 25-OH D was chosen for the general population primarily because of a lack of solid evidence provided by prospective controlled clinical trials to support the benefits of the higher threshold value, and because of potential adverse effects of higher 25-OH D values. The prior recommendations being appreciated, the Endocrine Society recommended a slightly higher lower limit of normal for serum 25-OH D concentration of $\geq 75$ nmol/L\textsuperscript{57} because of the patient subpopulation referred to endocrinologists for care, considerations based on calcium metabolism\textsuperscript{53, 58, 59}, and variation in 25-OH D assay standardization and reproducibility. Because persons with SCI have severe sublesional osteoporosis, often have reduced calcium intake, and have a tendency for low 25-OH D levels for a variety of reasons\textsuperscript{6}, setting the lower limit for 25-OH D at $\geq 75$ nmol/L in this population seems reasonable.

\begin{tabular}{|l|}
\hline
\textbf{VARIABLE NAME:} & Plasma parathyroid hormone (PTH) level \\
\textbf{DESCRIPTION:} & This variable documents the level of parathyroid gland function. \\
\textbf{CODES:} & Plasma PTH level in ng/L \\
\textbf{COMMENTS:} & \textit{Normal range}: 10-65 ng/L. Elevation in the plasma PTH often cause excessive bone loss. If plasma PTH is elevated, it may worsen the bone loss associated with SCI. Secondary hyperparathyroidism may occur in persons with SCI due to vitamin D deficiency and/or reduced vitamin D levels\textsuperscript{6}. \\
\hline
\end{tabular}

\begin{tabular}{|l|}
\hline
\textbf{VARIABLE NAME:} & Plasma/Serum N-telopeptide (NTX) concentration \\
\textbf{DESCRIPTION:} & This variable documents the level of bone resorption. \\
\textbf{CODES:} & Plasma/Serum NTX in nmol bone collagen equivalent (BCE) \\
\textbf{COMMENTS:} & \textit{Normal range for men}: 8.1-24.8 nmol BCE; \textit{normal range for women}: 7.7-19.3 nmol BCE. This test should be performed on an early morning blood collection. The measurement of specific degradation products of the bone matrix (e.g., metabolic markers of bone resorption and formation) provide analytical information concerning bone turnover\textsuperscript{60}. Because of diurnal variation in the values for biochemical bone markers, early morning sample collection is recommended for plasma/serum NTX, as well as for all other circulating bone markers. Increased osteoclast activity occurs \\
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\end{tabular}
soon after SCI and causes heightened bone resorption\textsuperscript{25, 61, 62}. The level of bone resorption may be determined by measuring biochemical markers of the bone matrix in the circulation. NTX is the N-terminal of the telopeptide of type 1 collagen, which is released during collagen degradation and has been used as a biochemical marker of bone resorption.

### Spot urine N-telopeptide (NTX) concentration

**DESCRIPTION:**
This variable documents the level of bone resorption.

**CODES:**
Urine NTX in nmol bone collagen equivalent (BCE)/mmol creatinine;

**COMMENTS:**
*Normal range in adults:* Males: 13-78 nmol BCE/mmol creatinine; Females: 14-74 nmol BCE/mmol creatinine. Please refer to the comments on the parameter entitled plasma/serum NTX. This test should be performed early in the morning on a urine second void collection. The level of bone resorption may be measured by determining the urinary excretion of NTX.

### Plasma/Serum C-terminal telopeptide (CTX) concentration

**DESCRIPTION:**
This variable documents the level of bone resorption.

**CODES:**
Plasma/Serum CTX in ng/L

**COMMENTS:**
*Normal range in adults:* Males: 18-29 years = 90–1200 ng/L, 30-49 years = 70-800 ng/L, 50-68 years = 90–350 ng/L, >68 years = not established; Females 18-29 years = 60–650 ng/L, 30-49 years = 40–460 ng/L; 50-68 years = not established, >68 years = not established. This test should be performed on an early morning blood collection. Please refer to the general comments on the variable entitled N-telopeptide concentration. CTX is the C-terminal of the telopeptide of type 1 collagen, which is released during collagen degradation, has been used as a biochemical marker of bone resorption. Because of diurnal variation in the values for biochemical bone markers, early morning sample collection is recommended for plasma/serum CTX.

### Plasma/Serum osteocalcin concentration

**DESCRIPTION:**
This variable documents the level of bone formation.
CODES: Plasma/Serum osteocalcin in µg/L

COMMENTS: Normal range in adults: 1.7-25 µg/L. This test should be performed on an early morning blood collection. Please refer to the general comments on the variable entitled N-telopeptide concentration. Increased osteoblast activity may occur immediately after SCI and it reflects increased bone turnover. The level of bone formation may be determined by measuring biochemical markers of the bone matrix in the circulation. Osteocalcin is a small non-collagenous protein that is synthesized by osteoblasts. Because of diurnal variation in the values for biochemical bone markers, early morning sample collection is recommended for plasma/serum osteocalcin.

VARIABLE NAME: Plasma/Serum procollagen type 1 N-terminal extension peptide (P1NP)

DESCRIPTION: This variable documents the level of bone formation.

CODES: Plasma/Serum P1NP in µg/L

COMMENTS: Normal range in adults: Males: 30-110 µg/L; Females: 20-106 µg/L. This test should be performed on an early morning blood collection. Please refer to the general comments on the variable entitled plasma/serum osteocalcin. P1NP is derived from procollagen, which is cleaved to form type 1 collagen from the N-terminal propeptide. Because of diurnal variation in the values for biochemical bone markers, early morning sample collection is recommended for plasma/serum P1NP.

VARIABLE NAME: Dual energy x-ray absorptiometry for bone mineral density (BMD)

DESCRIPTION: This variable documents bone mineral density at skeletal sites of interest, including the distal femur, proximal tibia, total hip, femoral neck, and radius (at one-third site).

CODES: Date: YYYYMMDD; Unknown

Region of skeleton osteoporotic: knee, hip, and radius:
If osteoporosis is present for persons ≥50 years old, place an “X” in the space provided:
Total Hip ___ (-2.5 or less SD) Femoral neck ___ (-2.5 or less SD)
Total Hip ___ (g/cm²) Femoral neck ___ g/cm²)
Radius (33%) ___ (-2.5 or less SD) Radius (33%) ___ g/cm²)
If Z-values are below the expected range for age for persons <50 years old, place an “X” in the space provided:

- Hip _____ (-2.0 or less SD)
- Radius _____ (-2.0 or less SD)
- BMD for the knee:
- Distal femur and Proximal tibia in g/cm²

**COMMENTS:**

**Osteoporosis:** In men and women age 50 or older, a T-score at or below -2.5 SD permits the diagnosis of osteoporosis.

**Determination of bone loss in men younger than 50 years of age and in pre-menopausal women:** The Z-score should be employed to assess bone loss; a Z-score ≤-2.0 is defined as below the expected range for age (Note: the diagnosis of osteoporosis cannot be made using the Z-score.). For consistency, the recommendation is to use the NHANES III database (http://www.cdc.gov/nchs/nhanes/nh3data.htm#17a) (for consistency of endpoints, without the proprietary database of the manufacturer) for each patient, who would then have their scores matched to this reference data base by age, gender and ethnicity. T-scores and Z-scores are not available for the distal femur and proximal tibia; as such, absolute scores for BMD of these regions of interest should be obtained. If serial scans are to be acquired in following potential bone loss, it would be important to standardize scans by their boney dimensions. At this time, only one company (GE Lunar) has FDA approved software specifically to acquire the knee in the adult, but other companies have adapted other software packages for this purpose as well. If the regions of interest (ROI) are meticulously obtained with appropriate software, then the results should be comparable regardless of the software employed to obtain the ROI. The International Society for Clinical Densitometry (ISCD) provides extensive, technical and clinical guidance on DXA acquisition, processing, and reporting; despite the technical differences and challenges that are well appreciated to exist between able-bodied persons and those with SCI, this information may be of assistance in the acquisition of DXA images on patients with SCI (see: www.iscd.org).

Immobilization results in bone loss, dependent upon the degree of inactivity and its duration⁰. Persons with more complete motor SCI who have the greatest neurological impairments and the most extreme degrees of physical immobilization would be expected to have the most rapid and marked bone loss, which appears to be progressive with the duration of injury⁵,⁶. The long-bone strength, and hence the risk of fractures, is related to bone mass and bone quality/microarchitecture⁷,⁸.

**PRIOR THYROID DISEASE**
VARIABLE NAME: Prior Thyroid Disease

DESCRIPTION: This variable documents the presence of known thyroid disease.

CODES: Absent; Present; Unknown  Date: YYYYMMDD; Unknown

If present, thyroid diagnosis:
Hashimoto’s disease
  Date disease diagnosed YYYYMMDD;  Unknown
Goiter: Diffuse toxic goiter; Diffuse nontoxic goiter; Nontoxic multinodular goiter; Toxic multinodular goiter
  Date disease diagnosed YYYYMMDD;  Unknown
Thyroiditis: Acute thyroiditis; Subacute thyroiditis
  Date disease diagnosed YYYYMMDD;  Unknown
Thyroid cancer: Papillary cancer; Follicular cancer; Medullary cancer; Anaplastic cancer; Other
  Date disease diagnosed YYYYMMDD;  Unknown
Thyroid nodule: Hyperfunctioning thyroid nodule; Hypofunctioning thyroid nodule
  Date disease diagnosed YYYYMMDD; Unknown
Other, specify
  Date disease diagnosed YYYYMMDD; Unknown

COMMENTS: In the adult, the thyroid gland regulates metabolic processes. The most common thyroid disorder is the diffuse goiter. Because as many as one-third of the world’s population have a low iodine intake, goiter is endemic, occurring in as high as 80% of iodine-deficient populations. Disorders of the thyroid gland are common with a strong female predominance, and they are also influenced by ethnicity and iodine intake. In iodine-replete areas, most disorders are the result of autoimmune phenomenon that stimulate the production and release of thyroid hormone (e.g., hyperthyroidism) or block the effect of endogenous TSH to stimulate thyroxine hormone production and/or cause destruction of the thyroid gland (e.g., hypothyroidism). Thyroid nodules are a common endocrine complaint, with the vast majority being benign with frequency dependent upon genetic predisposition and geographic location. Thyroid cancer is the most common malignancy of the endocrine system, and those that arise from the follicular epithelium are classified by histological features.

THYROID FUNCTION

CODE YYYYMMDD (Year – Month – Day)
### Thyroid gland size

**VARIABLE NAME:** Thyroid gland size  
**DESCRIPTION:** This variable permits a clinical evaluation of thyroid status.  
**CODES:** Goiter: absent; present  
**COMMENTS:** The size of the thyroid gland permits a clinical evaluation of its functional integrity. An enlarged thyroid gland; weight: >20 g estimated by palpation; volume: >17 cm³ by sonogram measurement may be the result of a functional disorder (either hyperthyroidism or hypothyroidism).

### Plasma/Serum thyroid stimulating hormone (TSH)

**VARIABLE NAME:** Plasma/Serum thyroid stimulating hormone (TSH)  
**DESCRIPTION:** This variable permits an evaluation of thyroid status.  
**CODES:** Plasma/Serum TSH in mU/L  
**COMMENTS:** Normal range: 0.5-5 mU/L. TSH measurement permits a biochemical evaluation of function of the thyroid gland. An elevated TSH value would be consistent with hypothyroidism, whereas a suppressed value would suggest hyperthyroidism. The sensitive TSH assay is often a component of routine blood panels but, if not, should be performed if there is clinical evidence of either hyper- (heat intolerance, excess sweating, unexplained weight loss, tachycardia, etc.) or hypo-activity (cold intolerance, dry skin, unexplained weight gain, bradycardia, etc.) of the thyroid gland.

### Plasma/Serum triiodothyronine (T₃)

**VARIABLE NAME:** Plasma/Serum triiodothyronine (T₃)  
**DESCRIPTION:** This variable permits an evaluation of thyroid status.  
**CODES:** Plasma/Serum T₃ in nmol/L  
**COMMENTS:** Normal range: 1.1-2.9 nmol/L. T₃ or T₄ are hormones released by the thyroid gland, and their measurement permits a biochemical evaluation of the function of this gland. The plasma/serum T₃ determination may be a component of routine blood panels but, if not, should be performed if there is clinical evidence of a thyroid disorder. An elevated T₃ value would be consistent with hyperthyroidism, whereas a low value would suggest
hypothyroidism.

**VARIABLE NAME:** Serum thyroxine (T₄)

**DESCRIPTION:** This variable permits an evaluation of thyroid status.

**CODES:** Serum T₄ in nmol/L

**COMMENTS:** *Normal range:* 64-154 nmol/L. Refer to comments on T₃. The plasma/serum T₄ determination may be a component of routine blood panels but, if not, should be performed if there is clinical evidence of a thyroid disorder. An elevated serum T₄ value would be consistent with hyperthyroidism, whereas a low value would suggest hypothyroidism.

**VARIABLE NAME:** Serum T₃ resin uptake (T₃RU)

**DESCRIPTION:** This variable permits an evaluation of thyroid hormone protein binding, as well as status of thyroid function.

**CODES:** Serum T₃RU

**COMMENTS:** *Normal range:* 0.25-0.35. The T₃RU is a traditional means to indirectly estimate the free T₃ hormone concentration. In a competitive binding manner, radiolabeled thyroid hormone competes with endogenous, or unlabeled thyroid hormone, to bind to a solid-phase matrix coated with T₃ antibody; the binding to the matrix is determined by the unoccupied T₃ binding sites (i.e., level of thyroid binding globulin) and the unlabeled, or endogenous, T₃. An elevated serum T₃RU value would be consistent with high thyroid hormone binding availability (i.e., increased thyroid binding globulin and/or hypothyroidism), whereas a low value would suggest low thyroid hormone binding availability (i.e., decreased thyroid binding globulin and/or hyperthyroidism).

**VARIABLE NAME:** Free T₄ (FT₄)

**DESCRIPTION:** This variable permits a direct evaluation of the bioactive form of thyroid hormone and status of thyroid function.

**CODES:** Serum FT₄ in pmol/L

**COMMENTS:** *Normal range:* 9-16 pmol/L. Measurement of the serum FT₄ level
determines the biologically active circulating T₄ hormone concentration. An elevated serum FT₄ value would be consistent with hyperthyroidism, whereas a low value would suggest hypothyroidism. If there is suspicion of pituitary and/or hypothalamic dysfunction (e.g., central or secondary thyroid disorders), the FT₄ level should be obtained in addition to the serum/plasma TSH value to assess thyroid status. In mild (or subclinical) hyperthyroidism, the plasma/serum TSH level is, by definition, slightly elevated while the FT₄ level is within the normal range.

**VARIABLE NAME:** Thyroid antibodies  
**DESCRIPTION:** This variable permits determination of an autoimmune thyroid condition.  
**CODES:** Thyroid antibodies: absent; present  
**COMMENTS:** If one or more anti-thyroid antibodies is determined to be present (i.e., anti-thyroglobulin, anti-thyroid peroxidase, and/or anti-TSH receptor), the presence of such antibodies will be recorded. The determination of thyroid antibodies should be performed if there is clinical evidence of a thyroid disorder that is not explained by other etiologies. Stress has been described to precipitate autoimmune thyroid disease in predisposed individuals. In the general population, autoimmune thyroid disease is highly prevalent, with women disproportionately affected. As many as 50% of people in the community have microscopic nodules, 3.5% have occult papillary carcinoma, 15% have palpable goiters, 10% demonstrate an abnormal thyroid-stimulating hormone level, and 5% of women have overt hypothyroidism or hyperthyroidism. In the general population, thyroid antibodies are usually present and detectable in the presence of autoimmune disease, and there is no reason to assume otherwise in those with SCI.

**VARIABLE NAME:** New Thyroid diagnosis  
**DESCRIPTION:** This variable identifies the specific diagnosis of thyroid disease.  
**CODES:** Hashimoto’s disease; Goiter: Diffuse toxic goiter; Diffuse nontoxic goiter; Nontoxic multinodular goiter; Toxic multinodular goiter Thyroiditis: Acute thyroiditis; Subacute thyroiditis Thyroid cancer: Papillary cancer; Follicular cancer; Medullary
cancer; Anaplastic cancer; Other
Thyroid nodule: Hyperfunctioning thyroid nodule; Hypofunctioning thyroid nodule
Other, specify

**COMMENTS:** Pituitary-hypothalamic insult at time of acute SCI, or in the immediate aftermath, should be considered. At the time of acute injury, in the absence of thyroid disease, thyroid function tests may be abnormal due to the stress of the event, intercurrent illness, and/or dietary restriction. However, it should be noted that stress has been described to precipitate thyroid disease in predisposed individuals. In the general population, autoimmune thyroid disease is highly prevalent, with women disproportionately affected; thyroid antibodies are usually present and detectable.

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**ADRENAL FUNCTION**

**CODE**

<table>
<thead>
<tr>
<th>YYYYMMDD (Year – Month – Day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
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</tbody>
</table>

**VARIABLE NAME:** Morning serum cortisol level

**DESCRIPTION:** This variable documents adrenal function.

**CODES:**

| 06-08 (a.m.) fasting serum cortisol level in nmol/L |

**COMMENTS:** *Normal range:* 140-690 nmol/L. Of note: During periods of stress, a “normal” serum cortisol level would be inappropriately low and suggest a deficiency state. Several of the symptoms of adrenal insufficiency may be found in persons with SCI, including weakness, gastrointestinal disorders, hypotension, and syncope. As such, a high index of suspicion for the diagnosis should be entertained. Pre-existing adrenal insufficiency can be a life-threatening event in the setting of catastrophic illness. Although uncommon, abdominal injury/surgery may predispose to hemorrhage and necrosis of the adrenal glands, and/or central nervous system injury, especially with more severe injury, and may result in hypothalamic stalk and/or pituitary compromise. Because of the catastrophic event of acute injury and the ever present potential for associated stressful events in the acute and subacute periods after injury, including hemorrhage, major organ damage, emergent and/or elective surgery, sepsis, coagulopathy, hypotensive and/or hypertensive crises, it is imperative to consider adrenal insufficiency at time of presentation after acute injury and
until full medical stabilization \(^{20}\). Although less commonly prescribed than in the past, the administration of high-dose methylprednisolone in an effort to reduce acute neurological injury may be associated with adrenal suppression, which may present as intractable hypotension, related to, or independent of, an intercurrent catastrophic event \(^{19}\). Even in the absence of antecedent glucocorticoid administration, persons with acute SCI may have adrenal insufficiency \(^{12}\). In those with chronic SCI, adrenal circadian rhythm and function has been shown to be generally normal \(^{76}\), but stimulation tests to determine adrenal reserve have shown abnormalities in functional capacity \(^{15}\).

### VARIABLE NAME: 24-hour urinary cortisol level

**DESCRIPTION:** This variable documents adrenal function.

**CODES:**
- 24-hour urine cortisol in nmol/24 hours

**COMMENTS:** *Normal range:* 55-276 nmol/24 hours. Of note: During periods of stress, a “normal” 24-hour urine cortisol excretion would be inappropriately low and suggest a deficiency state. Refer to above comment on serum cortisol level.

### GONADAL FUNCTION

**CODE**
- YYYYMMDD (Year – Month – Day)
- Unknown

### VARIABLE NAME: Testicular size *(men only)*

**DESCRIPTION:** This variable documents anatomical abnormality of the testes.

**CODES:**
- Testis: normal size; small

**COMMENTS:** *Normal adult size testes:* 3.5-5.5 cm in length; gonadal size to be determined by an ordinary ruler, an orchidometer, or ultrasonography \(^{77}\). Examination of the testes is an essential part of the evaluation of testicular function. Because age does not influence testicular size per se, documenting small testes is a significant finding, regardless of the individual’s age. Post-pubertal damage to the testes may result in small, soft testes. Thus, the absence of small testes would suggest the absence of significant damage to the seminiferous tubules (i.e., end-organ injury).
**VARIABLE NAME:** Plasma/Serum testosterone concentration (*men only*)  
**DESCRIPTION:** This variable documents testicular function.  
**CODES:** Plasma/Serum testosterone value in nmol/L  
**COMMENTS:** *Normal range for men:* 10-35 nmol/L. Because the serum testosterone concentration has a diurnal variation and falls throughout the day, it is recommended that levels be drawn early in the morning. Testosterone deficiency in the general population has been shown to occur in about 30% of men aged 40-79 years, with its prevalence increasing with more advanced age. In persons with SCI, the prevalence of testosterone deficiency is significantly greater. Clinical symptoms of testosterone deficiency include fatigue, decreased libido, erectile dysfunction, and negative mood. Testosterone has beneficial effects on body composition, specifically to maintain muscle mass and strength, as well as to reduce adiposity. The question of testosterone replacement therapy in men shown to be deficient may be considered. More recently interest has focused on the metabolic abnormalities that may be increasingly prevalent with testosterone deficiency, including type 2 diabetes mellitus, hypertension, and coronary artery disease.

**VARIABLE NAME:** Serum sex hormone binding globulin (SHBG) (*men only*)  
**DESCRIPTION:** This variable permits the determination of free sex steroids  
**CODES:** Serum sex hormone binding globulin in nmol/L  
**COMMENTS:** *Normal range: 9.5-65.0 nmol/L (for men).* Hormones that are insoluble in water require carrier mechanisms: transport proteins. The transport proteins function as reservoirs, with the hormones being in dynamic equilibrium of being bound or free, with a small fraction of free hormone in the circulation. Only the free hormone enters cells and has biological activity. Sex hormones (e.g. testosterone and estrogen) are weakly bound to albumin (~60%) and more tightly bound to a circulating binding protein, SHBG (~40%). The free and non-SHBG hormone concentrations, often referred to as “bioactive” testosterone concentration, can be calculated from the total testosterone concentration, serum albumin concentration, and SHBG value.
VARIABLE NAME: Serum albumin (men only)
DESCRIPTION: This variable permits the determination of serum albumin
CODES: Serum albumin in µmol/L
COMMENTS: Normal range: 540-740 µmol/L
Please refer to the comments on the parameter entitled serum SHBG. Albumin weakly binds hormones that are transported in the circulation. The free and “bioactive” hormone concentrations can be calculated from the total serum sex steroid concentration, serum albumin concentration, and SHBG value.

VARIABLE NAME: Serum bioactive testosterone (men only)
DESCRIPTION: This variable permits the determination of bioactive testosterone
CODES: Serum bioactive testosterone in pmol/L
COMMENTS: Normal range: 2,600-17,600 pmol/L (for men). Serum bioactive testosterone represents the fraction of circulating total testosterone that is either free or loosely bound to albumin (~60% of total testosterone concentration). Because the serum testosterone concentration has a diurnal variation and falls throughout the day, it is recommended that levels be drawn early in the morning. The bioactive testosterone is hypothesized to be the more active components of total testosterone. The free and “bioactive” hormone concentrations can be calculated from the total serum sex steroid concentration, serum albumin concentration, and SHBG value.

VARIABLE NAME: Serum free testosterone (men only)
DESCRIPTION: This variable permits the determination of free testosterone
CODES: Serum free testosterone in pmol/L
COMMENTS: Normal range: 113-750 pmol/L (for men). Serum free testosterone represents the fraction of circulating total testosterone that is not bound to SHBG or albumin (~2% of total testosterone concentration). Because the serum testosterone concentration has a diurnal variation and falls throughout the day, it is recommended that levels be drawn early in the morning. The free testosterone is hypothesized to be the most active component of total testosterone.
The free and “bioactive” hormone concentrations can be calculated from the total serum sex steroid concentration, serum albumin concentration, and SHBG value.

**VARIABLE NAME:** Plasma/Serum estradiol concentration (*women only*)

**DESCRIPTION:** This variable documents ovarian hormonal function.

**CODES:** Plasma/Serum estradiol in pmol/L

**COMMENTS:** *Normal range women:* basal: 70-220 pmol/L; ovulatory surge: >740 pmol/L; post-menopausal: >40 pmol/L. Estradiol concentrations reflect the integrity of ovarian sex hormone production, which also reflects the function of the hypothalamic-pituitary axis to release gonadotropins in an appropriate manner.

**ANTERIOR PITUITARY FUNCTION**

**CODE**

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<tbody>
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**VARIABLE NAME:** Plasma prolactin concentration

**DESCRIPTION:** This variable documents hypothalamic-pituitary integrity and/or dopaminergic tone.

**CODES:** Plasma prolactin in mmol/L

**COMMENTS:** *Normal range men & non-pregnant women:* 39-102 mmol/L. Plasma prolactin concentrations increase in the presence of reduced dopaminergic tone. It has been suggested that persons with chronic SCI have a dysfunction of central dopaminergic tone that may affect pituitary prolactin release, with a subset of persons with chronic SCI having elevated prolactin concentrations basally and a larger subset after provocative stimulation.

**VARIABLE NAME:** Plasma luteinizing hormone (LH) concentration

**DESCRIPTION:** This variable documents pituitary gonadotropic function.

**CODES:** Plasma LH in IU/L
COMMENTS: Normal range for men: 1.3-13 IU/L. The effects of SCI on sexual organs and function generally have different clinical courses in men and women. Pituitary-hypothalamic insult at time of acute SCI, or in the immediate aftermath, should be considered. In men with chronic SCI, reports have appeared to suggest that testosterone levels are depressed, with abnormalities of the pituitary-hypothalamic regulation of the gonads.

Normal range for women: basal: 0.8-26 IU/L; ovulatory surge: 25-57 IU/L; luteal <14 IU/L (time of menstrual cycle to be determined by clinical assessment using subjective information); postmenopausal: 40-104 IU/L.

The effects of SCI on sexual organs and function generally have different clinical courses in men and woman. Although menses may be temporarily interrupted at time of acute injury, the menstrual cycle usually returns thereafter, with full capacity to conceive.

VARIABLE NAME: Plasma follicular stimulating hormone (FSH) concentration
DESCRIPTION: This variable documents pituitary gonadotropic function.
CODES: Plasma FSH in IU/L
COMMENTS: Normal range for men: 0.9-15 IU/L.
Normal range for women: basal: 1.4-9.6 IU/L; ovulatory surge: 2.3-21 IU/L; luteal <7 IU/L; postmenopausal: 34-96 IU/L.

VARIABLE NAME: Plasma insulin-like growth factor-1 (IGF-1).
DESCRIPTION: This variable will permit evaluation of integrated plasma growth hormone concentrations.
CODES: Plasma IGF-1 in kU/L
COMMENTS: Normal range for men: 0.34-2.2 kU/L. Normal range for women: 0.45-1.9 kU/L. Pituitary-hypothalamic dysfunction may occur in persons with SCI at time of acute SCI or may develop years afterward. The response of growth hormone to provocative stimulation has been shown to be blunted in persons with SCI. Plasma insulin-like growth factor, in the absence of liver disease, provides an estimate of integrated daily growth hormone release.

VARIABLE NAME: Time of the menstrual cycle (women only)
### DESCRIPTION:
This variable documents the time of the menstrual cycle or if the woman is postmenopausal.

### CODES:
Follicular phase, ovulatory surge, luteal phase, postmenopausal

### COMMENTS:
Values for serum estradiol and gonadotropins are dependent upon the time of the menstrual cycle or if postmenopausal.

### POSTERIOR PITUITARY FUNCTION

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<tr>
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### VARIABLE NAME:
Plasma copeptin

### DESCRIPTION:
This variable reflects the secretion of vasopressin by the posterior pituitary.

### CODES:
Plasma copeptin in pmol/L

### COMMENTS:
*Normal range*: 1.7-11.25 pmol/L

Central diabetes insipidus results from the inability to secrete vasopressin to appropriately concentrate the urine. If there is clinical suspicion for diabetes insipidus, which would include a hyperosmolar state (e.g., hypernatremia) in association with relatively dilute urine, a plasma copeptin level should be considered. Vasopressin secretion is pulsatile and its residence time in the circulation is low. As such, the measurement of copeptin, the C-terminal portion of pre-provasopressin (i.e., a peptide secreted in equimolar amounts to vasopressin) affords a practical alternative to measurement of vasopressin. If during fluid restriction the serum copeptin concentration does not increase, and/or the serum sodium concentration is elevated in the presence of dilute (hypoosmolar) urine, a dysfunction of vasopressin release from the posterior pituitary may be present. A fluid deprivation test with DDAVP should be considered.

### VARIABLE NAME:
Fluid deprivation test with desmopressin (DDAVP).

### DESCRIPTION:
This variable permits evaluation for diabetes insipidus.

### CODES:
Fluid deprivation test: Positive or Negative
**COMMENTS:**

Normal response: >50% in urine osmolarity (positive test)

Posterior pituitary dysfunction may occur in persons with SCI at time of acute SCI, or may develop years afterward. Head trauma not infrequently occurs with SCI, with as high as 60% of those with traumatic SCI also sustaining a TBI, and 2% of cases of head trauma cases have been reported to be associated with diabetes insipidus. If there is a central deficiency of vasopressin (also known as antidiuretic hormone), then there will be difficulty in concentrating the urine (<300 mosmol/L) and an increase in urine volume (>50 ml/kg). If there is clinical suspicion for diabetes insipidus, which would include a hyperosmolar state (e.g., hypernatremia) in association with urine which is relatively dilute, a fluid deprivation test should be considered. After ad libitum fluid intake, fluid intake is restricted (usually in the morning) until urine concentration increases to >300 mosmol/L or increases to a specific gravity >1.010. However, before the body weight decreases by 5% during fluid restriction, and if the urine does not concentrate and the plasma osmolarity and/or serum sodium concentration exceed the upper limit of normal, then intravenous or subcutaneous desmopressin (DDAVP, 0.03 µg/kg) should be administered with the urine osmolarity measured 1 to 2 hours later. If the urine concentrates sufficiently after DDAVP administration, then central diabetes insipidus is diagnosed; if the urine does not concentrate after DDAVP, renal resistance to DDAVP is to be considered.

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**SYMPATHETIC NERVOUS SYSTEM FUNCTION**

<table>
<thead>
<tr>
<th>CODE</th>
<th>YYYYMMDD (Year – Month – Day)</th>
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<tbody>
<tr>
<td></td>
<td>Unknown</td>
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</tbody>
</table>

**VARIABLE NAME:** Plasma norepinephrine (NE)

**DESCRIPTION:** This variable documents the integrity of the sympathetic nervous system.

**CODES:**

- Plasma NE supine in nmol/L
- Plasma NE seated/standing in nmol/L

**COMMENTS:**

Normal range: supine = 0.74-1.41 nmol/L; seated/standing = 1.68-2.44 nmol/L. Impairment of autonomic (e.g., sympathetic nervous system) integrity will compromise the ability to maintain blood pressure with upright posture due to absence of a vasopressor response. NE is a neurotransmitter released by post-synaptic...
sympathetic neurons, which binds to the vascular walls, causing peripheral vasoconstriction, thereby opposing hemodynamic fluid shifts to the dependent circulation during upright positioning. Inadequate post-synaptic NE release results in hemodynamic instability and orthostatic hypotension. Levels of plasma NE are low in individuals with cervical SCI in the supine resting position (0.40 nmol/L) and upright positions (0.75 nmol/L). In individuals with a higher cord lesion who appear to have difficulty in maintaining blood pressure with upright positioning, partial or total ablation of the sympathetic response should be considered, which may be reflected by resting supine levels below 0.56 nmol/L and an attenuated plasma NE response to head-up tilt.

**RENIN-ALDOSTERONE AXIS FUNCTION**

**VARIABLE NAME:** Plasma renin activity (PRA)

**DESCRIPTION:** This variable documents the integrity of one component of the renal response to hypotension.

**CODES:**
- Plasma renin supine in µg/L/h
- Plasma renin seated/standing in µg/L/h

**COMMENTS:** Normal range: supine = 0.3-3.0 µg/L/h; seated/standing = 0.7-5.0 µg/L/h. PRA is reported to be elevated in response to head-up tilt in individuals with cervical SCI. Normal salt and water metabolism is essential for maintenance of cardiovascular homeostasis. With a fall in blood pressure, the renin-aldosterone system is activated. In the presence of renal insufficiency, a deficient plasma renin response will result in impaired renal retention of salt and water due to the inability to appropriately stimulate aldosterone release from the adrenal cortex.

**VARIABLE NAME:** Serum aldosterone

**DESCRIPTION:** This variable documents the integrity of one component of the adrenal cortical response to hypotension.

**CODES:**
- Serum aldosterone supine in pmol/L
- Serum aldosterone seated/standing in pmol/L
COMMENTS: Normal range (normal diet): supine = <240 pmol/L; seated/standing = 140-560 pmol/L. Serum aldosterone concentrations are within the normal range in individuals with cervical SCI in the supine position (228 pmol/L), but heightened serum aldosterone responses to head-up tilt have been reported (700 pmol/L)\textsuperscript{10,11,99}. Appropriate regulation of salt and water metabolism to upright posture by activation of the renin-aldosterone system is essential for maintenance of cardiovascular homeostasis\textsuperscript{10,98}. A deficient serum aldosterone response to upright posture will result in impaired hemodynamic regulation due to the inability to appropriately retain salt and water by the kidney.
Appendix  INTERNATIONAL SPINAL CORD INJURY DATA SETS

INTERNATIONAL SPINAL CORD INJURY ENDOCRINOLOGY AND METABOLISM
EXTENDED DATA SET — DATA FORM (Version 1.0)

Carbohydrate Metabolism:  Date YYYYMMDD;  □ Unknown
Plasma glucose:
   Fasting _____ mmol/L;
   2 hours _____ mmol/L;
OGTT diagnostic classification:  □ normal;  □ Impaired Glucose Tolerance;  □ Diabetes Mellitus
Plasma insulin:
   Fasting _____ pmol/L;
   2 hours _____ pmol/L;
Hemoglobin A1c:  ________________ %;

Calcium & Bone Metabolism:  Date YYYYMMDD;  □ Unknown
Plasma/Serum calcium _____ mmol/L;
Plasma ionized calcium _____ mmol/L
Urine calcium _____ mmol/24 hours;
Urine calcium/creatinine _____ mmol/mg;
Serum 25-OH D:  ____ nmol/L;
Plasma parathyroid hormone (PTH) level:  ____ ng/L;

Plasma/Serum N-telopeptide _____ nmol BCE;
Urine N-telopeptide ________ nmol BCE/mmol creat;
Plasma/Serum C-telopeptide ________ ng/L;
Plasma/Serum osteocalcin ________ µg/L;
Plasma/Serum P1NP________ µg/L;

Dual energy x-ray absorptiometry:  Date YYYYMMDD;  □ Unknown
If osteoporosis (-2.5 or less SD) is present for persons ≥50 years old, place an “X” in the space
provided for each skeletal site of interest:
Total Hip _____  Femoral neck _____  Radius _____
Bone mineral density (BMD) for each the skeletal sites of interest:
   Total Hip ________ (g/cm²)
   Femoral neck ________ (g/cm²)
   Distal femur ________ (g/cm²)
   Proximal tibia ________ (g/cm²)
   Radius ________ (g/cm²)
If Z-values are below the expected range for age for persons <50 years old, place an “X” in the
space provided:
   Hip ________ (-2.0 or less SD)  Radius ________ (-2.0 or less SD)

Prior Thyroid Disease (to be filled in once only):
□ Absent  □ Present  □ Unknown  Date: YYYY/MM/DD  □ Unknown
If present, thyroid diagnosis
□ Hashimoto’s disease  Date disease diagnosed YYYYMMDD  □ Unknown
Goiter: □ Diffuse toxic goiter □ Diffuse nontoxic goiter □ Nontoxic multinodular goiter  □ Toxic multinodular goiter  □ Date disease diagnosed YYYYMMDD □ Unknown
Thyroiditis: □ Acute thyroiditis □ Subacute thyroiditis  □ Date disease diagnosed YYYYMMDD □ Unknown
Thyroid cancer: □ Papillary cancer □ Follicular cancer □ Medullary cancer □ Anaplastic cancer □ Other □ Date disease diagnosed YYYYMMDD □ Unknown
Thyroid nodule: □ Hyperfunctioning thyroid nodule □ Hypofunctioning thyroid nodule □ Date disease diagnosed YYYYMMDD □ Unknown
□ Other, specify □ Date disease diagnosed YYYYMMDD □ Unknown

**Thyroid Function:**
*Thyroid function incl. laboratory tests/new diagnosis:* Date: YYYY/MM/DD □ Unknown
Thyroid gland size: Goiter: □ absent □ present
Plasma/Serum thyroid stimulating hormone (TSH) _____ mU/L;
Plasma/Serum triiodothyronine (T3) ______ nmol/L
Serum thyroxine (T4) _______nmol/L
Serum T3 resin uptake (T3RU) _______
Plasma/Serum free thyroxine (FT4)_______pmol/L
Thyroid antibodies: □ absent □ present;
*New thyroid diagnosis:*
□ Hashimoto’s disease
Goiter: □ Diffuse toxic goiter □ Diffuse nontoxic goiter □ Nontoxic multinodular goiter  □ Toxic multinodular goiter
Thyroiditis: □ Acute thyroiditis □ Subacute thyroiditis
Thyroid cancer: □ Papillary cancer □ Follicular cancer □ Medullary cancer □ Anaplastic cancer □ Other
Thyroid nodule: □ Hyperfunctioning thyroid nodule □ Hypofunctioning thyroid nodule □ Date disease diagnosed YYYYMMDD □ Unknown
□ Other, specify_____

**Adrenal Function:** Date YYYYYMMDD; □ Unknown
06-08 (a.m.) fasting serum cortisol _____ nmol/L;
24-hour urine cortisol ____ nmol/24 hours;

**Gonadal Function:** Date YYYYYMMDD; □ Unknown
Men:
Testis □ normal size □ small;
Plasma/Serum testosterone _____ nmol/L;
Serum sex hormone binding globulin _____ nmol/L
Serum albumin _____ µmol/L
Serum bioactive testosterone ______ pmol/L
Serum free testosterone _____ pmol/L
Women:
Plasma/Serum estradiol _____ pmol/L;

**Anterior Pituitary Function:** Date YYYYYMMDD; □ Unknown
Plasma Prolactin _____ mmol/L;
Plasma luteinizing hormone (LH) ______ IU/L;
Plasma follicular stimulating hormone (FSH) ______ IU/L;
Plasma insulin-like growth factor-1 (IGF-1) (baseline) ______ kU/L;

Women:
Identify the time of menstrual cycle (basal, ovulatory surge, postmenopausal) ___________

Posterior Pituitary Function:
Date YYYYMDD; □ Unknown
Plasma copeptin ______ pmol/L;
Fluid deprivation test with DDAVP □ positive □ negative

Sympathetic Nervous System Function:
Date YYYYMDD; □ Unknown
Plasma norepinephrine supine ______ nmol/L
Plasma norepinephrine seated/standing ______ nmol/L

Renin-Aldosterone Axis Function:
Date YYYYMDD; □ Unknown
Plasma renin supine ______ µg/L/h
Plasma renin seated/standing ______ µg/L/h
Serum aldosterone supine ______ pmol/L
Serum aldosterone seated/standing ______ pmol/L

Conversion Factor (CF) × Conventional (C) = System of International Units (SI)

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<td>Glucose</td>
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<td>Insulin</td>
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<td>Total Calcium (plasma)</td>
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<tr>
<td>25-Hydroxycholecalciferol (25-OH-D)</td>
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<td>Thyroxine (T₄)</td>
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<td>Triiodothyronine (T₃)</td>
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<td>Free Thyroxine (FT₄)</td>
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<td>Cortisol</td>
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<td>Estradiol</td>
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