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Osteoporosis Associated with the Treatment of Paraphilias: A Clinical Review of Seven Case Reports*

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ABSTRACT: Osteoporosis and long-term androgen suppression in the treatment of paraphilias has been documented with surgical castration and the use of gonadotropin-releasing hormone agonists. The literature has suggested that the use of cyproterone acetate (CPA) may be protective against osteoporosis, although there are case reports of osteoporosis in men treated with CPA. This pilot study represents a case series of seven patients diagnosed with severe paraphilias and treated with CPA, leuprolide, or surgical castration. Two of the four patients treated with CPA developed significant osteoporosis, while the other two had normal bone density studies. The remaining three patients, one treated with leuprolide and two with surgical castration, had osteopenia. Based upon the current literature, the finding of significant osteoporosis in two of four patients treated with CPA, but not those treated with leuprolide or castration, is surprising. Monitoring of all patients treated with long-term androgen suppression for osteoporosis is suggested.

KEYWORDS: forensic science, forensic psychiatry, osteoporosis, cyproterone acetate, bilateral orchidectomy, leuprolide

The treatment of paraphilias may involve a combination of cognitive-behavioral and pharmacological interventions (1,2). Medications that may be utilized by the clinician include antiandrogen medications, such as cyproterone acetate (CPA) (3) or medroxyprogesterone acetate (MPA) (4), gonadotropin-releasing hormone (GnRH) agonists, such as leuprolide that produce a pharmacological "castration" (5,6), or alternatively, surgical castration by means of bilateral orchidectomy (7,8). Regardless of the method used, the goal in treating patients with paraphilias is the reduction of sexually deviant fantasies and behaviors through a diminution in the plasma androgen levels (1). However, a number of side effects have been observed with both the medical and surgical interventions. One significant adverse effect of the hypoandrogen state is osteoporosis, a disease that has the potential for serious morbidity and mortality as a result of the increased risk of hip and spine fractures (9–11).

Osteoporosis is defined as a reduction in bone mass (12,13). Peak bone mass typically is achieved between the ages of 20 and 40 years, after which bone mass is lost naturally at a rate of 0.5 to 1% each year (12). In the United States, currently about 2 million men over the age of 50 are estimated to have osteoporosis and approximately 12 million have low bone mass or osteopenia (14,15). It is estimated that the lifetime risk of an osteoporotic fracture of the hip, spine, or wrist in men after the age of 50 may range from 5% (16) to as high as 25%, approximately half the rate in women (17). Osteoporosis in men is usually associated with secondary causes such as hypogonadism, chronic alcohol use, endocrine imbalance, and long-term glucocorticoid use (16), with chronic androgen insufficiency playing a major role (18).

The degree of osteoporosis may be categorized according to the loss in bone mineral density (BMD). BMD is usually expressed as a T-score, which represents the number of standard deviations (SDs) that the patient's bone density differs from the mean BMD for a normal young adult. According to the World Health Organization, a BMD greater than 2.5 SDs below the young adult mean value is consistent with a diagnosis of osteoporosis, while a BMD between 1 and 2.5 SDs below the mean value is indicative of osteopenia (13). Severe osteoporosis is defined as a BMD value more than 2.5 SDs below the mean for young adults in the presence of one or more fragility fractures (12).

Within adult bone, remodeling is a balance between the activity of the osteoblasts, which form the bone, and osteoclasts, which break down or resorb the bone (19). Androgens, progesterone, Vitamin D, and calcitonin act to promote bone growth, while parathyroid hormone, thyroid hormone, and glucocorticoids promote bone lysis (16,19,20). Low androgen levels lead to reduced bone remodeling, low serum 1,25-dihydroxy Vitamin D levels, and reduced bone formation (16). Estrogens also play an important role in bone growth in women and men (12,21).

Risk factors associated with the development of osteoporosis include age, white or Asian origin, family history of osteoporosis or

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fractures, low body mass index (BMI), smoking, heavy alcohol consumption, sedentary lifestyle with nonweight-bearing activity, low calcium and Vitamin D intake, female sex, early menopause and endocrine problems such as hyperthyroidism, hyperparathyroidism, and hypogonadism (12,13,16,19). Hyperprolactinemia has effects on both calcium and estrogens; therefore, it may also lead to osteoporosis (22–24). The development of osteoporosis has also been linked to the use of drugs, including glucocorticoids, lithium, ethanol, and anticonvulsants (20). In patients treated with long-term glucocorticoid therapy, fractures may be evident in up to 50% of the patients (25,26) and bone loss may be dose-dependent (27).

Androgen suppression is the desired outcome in the treatment of paraphilias such as pedophilia and sexual sadism. This is based upon the assumption that paraphilias result from excessive sexual preoccupations and urges and are associated with the level of testosterone (1,6,28,29). Interventions used to reduce testosterone levels include medications such as CPA and leuprolide because of their ability to reduce testosterone levels and surgical castration or bilateral orchidectomy.

Orchidectomy has been used to suppress testosterone levels in the treatment of prostate cancer (30) and in the treatment of paraphilias (7,8). With the removal of the testes, the major source of testosterone in the body is gone. The adrenal cortex does produce dehydroepiandrosterone (DHEA), which is metabolized to testosterone, as well as small amounts of testosterone (31). Adverse effects related to this irreversible condition include elevation of LH and FSH due to the reduction in testosterone, anemia, change in fat distribution and a decrease in beard and body hair (32). Osteoporosis has been reported in men undergoing castration (32–35), but the prevalence of osteoporosis in such individuals has been not clearly established.

Leuprolide is a gonadotropin-releasing hormone analogue (GnRH) that initially acts to increase levels of the gonadotropins, LH and FSH, and testosterone. With chronic use, the pituitary GnRH receptors become desensitized, leading to suppression of the gonadal steroids and the gonadotropins (36,37). Leuprolide has been used in the treatment of hormone-dependent tumors, such as in prostatic cancer, since the amount of circulating testosterone is reduced to castration levels (38). Leuprolide and other GnRH analogues have been used to treat paraphilias because of their ability to produce a reversible state of androgen suppression (5,6). Side effects of leuprolide include temporary renal impairment during initial administration, hot flashes, testicular atrophy, gynecomastia, reduction in libido, pain at the site of injection, congestive heart failure, angina, and mood swings (36,37). The hypogonadal state produced by the GnRH agonists may increase the sensitivity of the bone tissue to the resorptive effects of parathyroid hormone (39). Osteoporosis has been documented in patients taking GnRH analogues (5,6,16,40,41), although the bone loss may be reversible if the medication is discontinued (42). As with surgical castration, the prevalence of osteoporosis associated with GnRH agonist use has not been clearly established, although one study involving the use of leuprolide in the treatment of prostate cancer indicated a 6% rate of bone fractures (41).

Cyproterone acetate (CPA) is a steroid that blocks the binding of dihydrotestosterone to androgen receptors. As a result, spermatogenesis and sexual drive are reduced. CPA has progestational activity and inhibits the secretion of luteinizing hormone (LH) and follicle-stimulating hormone (FSH), leading to diminished production of testicular testosterone (37,43). Side effects include hypercalcemia, impaired carbohydrate metabolism, changes in lipid profile, weight gain, gynecomastia, reduction in libido, hot flashes, exacerbation of thromboembolic disease, hypochromic anemia and liver dysfunction (37,43–47).

It is thought that since CPA has progestational activity, it may not result in an increase in bone resorption (19,20). Women using CPA as an oral contraceptive at a dose of 2 mg, along with 35 mg of ethinylestradiol, were noted to have no changes in bone density when tested at the end of two years of use (48). CPA has been used in combination with estradiol valerate to treat bone loss in menopausal women and in amenorrheic athletes with improvements in BMD (49–51). Progestogens may promote bone growth in postmenopausal women but not premenopausal women (20). In men, the research on the association between development of osteoporosis and the use of CPA has been limited to case reports (52,52), with one case report suggesting the osteoporosis is reversible upon withdrawal of the CPA (53).

Management of osteoporosis involves the prevention of the disease and treatment of the disease once it develops. Preventative measures encompass an adequate dietary calcium and Vitamin D content, regular weight-bearing exercise and abstinence from cigarette use (12,53). Treatment of osteoporosis may involve the use of pharmacological agents, such as bisphosphonates (etidronate or alendronate), that suppress bone resorption, estrogen replacement therapy to prevent bone loss, selective estrogen receptor modulators (SERMs) that produce estrogenic effects on estrogen-responsive tissues like bone, and calcitonin (12,53). Vitamin D (400 to 800 IU/day) and calcium are recommended in the treatment of osteoporosis for women (54).

This study represents a case series of seven patients treated with long-term androgen suppression for severe paraphilias. The seven patients may be divided into two groups based upon degree of androgen suppression, with one group consisting of "castration" levels of testosterone (patients who were surgically castrated or on GnRH agonists) and the other group with normal or low-normal testosterone levels (patients taking CPA). The current literature suggests that osteoporosis may be more prevalent in the first group and that CPA may protect patients, such as those in the second group, from the development of osteoporosis. The purpose of the case series was to explore the association between long-term androgen suppression with CPA and the development of osteoporosis.

Methods

The seven patients were selected from those patients treated by forensic psychiatrists at the Royal Ottawa Health Care Group for severe paraphilias with long-term androgen suppression. The Royal Ottawa Health Care Group is a teaching hospital with two campuses (Royal Ottawa Campus and Brockville Campus) and is associated with the University of Ottawa, Ontario, Canada. The outpatients consisted of two groups: those seeking treatment on a voluntary basis, having either served time for previous sexual offense convictions or had never been charged with a sexual offense, and those patients who come under the jurisdiction of the Ontario Review Board (ORB), having been found NGRI (not guilty by reason of insanity) or NCR (not criminally responsible), the more recent term for NGRI (55). The inpatients consisted of those patients under the jurisdiction of the ORB. The ORB is a provincial quasi-judicial board established pursuant to the Criminal Code of Canada to determine disposition, based upon whether the patient poses a significant threat to public safety (55). The ORB has similar duties to the Connecticut Psychiatric State Review Board.

The clinical histories of the patients were reviewed and the following data collected: psychiatric diagnoses, medications

(including current and past antiandrogen medications) and risk factors for osteoporosis (history of fractures; history of diabetes, thyroid disease, or renal stone disease; history of steroid, anticonvulsant, or anticoagulant use; smoking; alcohol use; type of exercise; any loss of height or weight; inadequate Vitamin D or calcium intake; family history of osteoporosis). The results of the following blood work were collected: complete blood count, electrolytes, calcium, phosphate, AST (aspartate aminotransferase), ALT (alanine aminotransferase), gamma-GT (gamma-glutamly transpeptidase), total bilirubin, alkaline phosphatase, albumin, total protein, thyroid stimulating hormone (TSH), parathyroid hormone (PTH), 25OH Vitamin D, BUN, creatinine, and sex hormone profile (free testosterone, bioavailable testesterone, total testosterone, LH (luteinizing hormone), FSH (follicle-stimulating hormone), estradiol, progesterone, and prolactin). Bone densitometry results and electrocardiogram results were reviewed.

Results

The clinical histories of the seven patients are presented in Table 1. The patients may be divided into two groups, based upon the degree of androgen suppression according to the level of free and total testosterone levels, as outlined in Table 2. Patients 1, 2, and 3 have significant androgen suppression, while Patients 4, 5, 6, and 7 have testosterone levels within the normal range or just below the normal range.

Patient 1 had a baseline bone mineral density (BMD) examination done in 1998 (see Table 3) at the time of commencement of leuprolide, which showed mild osteopenia of the lumbar spine only. The patient was referred to an endocrinologist who recommended cyclical etidronate and Vitamin D 400 International Units (IU) daily. He was not to take prescribed supplemental calcium. A repeat BMD done one year later showed a slight increase in the bone density of the lumbar spine (+0.2% change) but a significant reduction of the femur bone density (−3.3% change), but not severe enough to be labeled as osteopenia. The patient was referred again to the endocrinologist, who made no changes to the dose of etidronate or Vitamin D. The details of this patient's clinical history and previous treatment are outlined in a previous paper (56).

Patient 2 requested surgical castration in 1990, and a BMD done in early 2001 demonstrated minimal osteopenia of the lumbar spine. Patient 3, the eldest patient in the series, requested surgical castration in 1998. His family doctor referred him to an endocrinologist in 1999. Densitometry of the lumbar spine was not feasible because of advanced degenerative changes. Lumbar X-rays revealed minor osteoporotic changes with narrowing of the disc spaces. BMD of the femur showed osteopenia. A 24-h urine collection showed an elevated calcium level, and, as a result, he does not take supplemental calcium.

Patient 4 had two bone density scans, in 1998 and 2000, both showing normal bone density. Although it has been recommended to the patient to take supplemental calcium and Vitamin D, he does not do so for financial reasons. Patient 5 also does not take supplemental calcium and Vitamin D for financial reasons. While a BMD done in 2000 was normal, thoraco-lumbar spine X-rays demonstrated degenerative sclerosis that, according to the radiologist reading the films, may falsely elevate the spine BMD.

Patient 6 was referred to an endocrinologist after a BMD done in 2000 indicated osteoporosis of the lumbar spine and osteopenia of the femur. Thoraco-lumbar spine X-rays showed mild to moderate bone loss with compensatory increased cortical bone. His 24-h urine was normal for calcium, creatinine, and sodium.

Patient 7, the youngest patient in this series, was referred to an endocrinologist because a BMD done in 2000 indicated severe osteoporosis of the lumbar spine and significant osteopenia of the femur. Thoraco-lumbar spine X-rays showed a thickening and widening of vertical trabecular bone and anterior penciling, indicative of compensatory thickening of the cortical bone. There was also a 20% concave fracture in T6. The patient reported a loss of 1 in. in height. Cyclical etidronate was commenced in addition to calcium and Vitamin D supplements. The rate of bone resorption has been monitored by the serum c-telopeptides, but the patient's response has been less than anticipated.

Of the blood work ordered for these patients, no abnormalities were noted with the BUN, creatinine, 25OH Vitamin D, PTH, TSH, AST, gamma GT, alkaline phosphatase, calcium, albumin, total protein, and random glucose. All patients had significantly reduced estradiol levels. With the exception of Patient 5, all patients demonstrated mild anemia. All patients had 25OH Vitamin D levels, PTH and TSH levels within normal range, indicating the absence of an underlying endocrine problem. Patient 4 has consistently demonstrated an elevation of ALT, while Patient 5 had hypophosphatemia. No abnormalities were noted in any of these patients' electrocardiograms.

Discussion

The literature to date has suggested that because of the progestational action of CPA, taking this medication may be protective in the development of osteoporosis (19,20). In fact, CPA has been used to treat low bone density in women (48–50). There are two case reports of reduced bone density in men treated with CPA for paraphilias (51,52). Thus, based upon the current literature, the finding of severe osteoporosis in Patient 7, given his young age, is a surprising but disturbing finding. Confounding the picture in this patient is the presence of a large number of risk factors for the development of osteoporosis, including a past history of renal stone disease (suggesting an underlying problem with calcium and phosphorous metabolism), low body mass index, loss of height and weight, and a previous fracture. It is difficult to determine the contributory effect of CPA on the development of osteoporosis and the vertebral fracture in light of the other risk factors.

Patient 6 also had osteoporosis of the lumbar spine. His risk factors for osteoporosis were few in number compared to Patient 7 but included weightless exercise (scuba diving and swimming), a sedentary lifestyle, and smoking. Both patients had taken CPA for several years, although at a relatively low dose. Given the relative lack of risk factors for osteoporosis in this patient, and given his age (41 years), the finding of osteoporosis is again surprising and disturbing.

Patients 4 and 5 did not have osteoporosis despite long-term use of high-dose CPA and the presence of risk factors for osteoporosis, including diabetes and a previous fracture in Patient 4. Based upon a comparison of the four patients taking CPA, it may be said that osteoporosis should be considered to be a potential side effect of the medication.

Patients 1, 2, and 3 were included in the series to provide a contrast with respect to androgen suppression and bone mass loss. One would expect, given the significantly low levels of testosterone arising from both surgical castration and leuprolide use, more severe osteoporosis than was found (16,18,41,57). In one study, bone loss in men being treated with GnRH agonists, antiandrogen medication or surgical castration for prostate cancer approached 4% per year in the first two years of treatment and 2% per year after Year 4 (35).

TABLE 1—*Clinical histories of seven patients treated for paraphilias.*

	PATIENT 1	PATIENT 2	PATIENT 3	PATIENT 4	PATIENT 5	PATIENT 6	PATIENT 7
Age and Race	40 years Caucasian	54 years Caucasian	61 years Caucasian	41 years Mediterranean	49 years Caucasian	47 years First Nations*	36 years Caucasian
Index Offence	Sexually sadistic murder of 8-year-old boy when pt was 15	Convicted indecent assault ×3; male victims ages 12–13	Has not been charged or convicted; male and female victims ages 9–15	Attempted murder of elderly woman	Indecent assault ×11, Buggery; male & female victims ages 4–11	Sexually motivated murder of 15-year-old boy	Sexually motivated murder of 25-year-old woman
Legal Status	NGRI† 1976 Inpatient medium secure forensic unit	Voluntary Outpatient	Voluntary Outpatient	NGRI 1976 Living in community for one year	NGRI 1980 Living in community for two years	NGRI 1979 Inpatient minimum secure forensic unit	NGRI 1986 Living in community for five years
Diagnoses	Sexual sadism; Pedophilia; Borderline; Personality Disorder; Temporal Lobe Epilepsy	Pedophilia, Nonexclusive Type	Pedophilia, Nonexclusive Type; Major Depressive Disorder, Recurrent	Sexual sadism; Panic disorder; Antisocial Personality Disorder; Non-insulin Dependent Diabetes Mellitus	Sexual sadism; Pedophilia; Antisocial Personality Disorder; Lower Lumbar Disc Degeneration; Past history of substance abuse	Sexual sadism; Pedophilia; Personality Disorder NOS	Sexual sadism; Voyeurism
Previous Treatment for Paraphilias‡	CPA oral max dose 300 mg/day ×16 years; Leuprolide 7.5 mg IM q4wks ×1 year, 11.25 mg IM q4wks ×2 years	CPA oral 50 mg/day ×9 months; MPA oral 200 mg/day ×9 months	CPA intermittently ×10 years; max dose 200 mg IM q2wks ×5 months	CPA oral max dose 200 mg/day ×12 years; CPA 12.5 mg q2day ×1 year	CPA max 300 mg IM q1wk ×11 years; CPA 24 mg/day ×2 years	CPA 75 mg/day ×6 years	CPA 50 mg/day ×10 years
Current Treatment	Leuprolide 11.25 mg IM q4wks	Surgical castration 1990	Surgical castration 1998	CPA 12.5 mg q2days	CPA 25 mg/day	CPA 75 mg/day	CPA 50 mg/day
Other Medications	Sertraline; Carbamazepine; Celecoxib; Vit D; Cyclical; Etidronate; Ranitidine	Vit D & Calcium supplements	Sertraline	Fluvoxamine	None	Vit D & Calcium carbonate supplements	Vit D & Calcium supplements; Cyclical etidronate
Risk Factors for Osteoporosis	Carbamazepine; Sedentary lifestyle; Smoking; Low calcium intake; Low estradiol & testosterone	Age; Sedentary lifestyle; Low estradiol & testosterone	Age; Loss of height; Low estradiol & testosterone	Previous fracture; Sedentary lifestyle; Weightless exercise; Smoking; Diabetes; Low estradiol & testosterone	Past history of heavy alcohol use; Sedentary lifestyle; Smoking; Weightless exercise; Low estradiol	Sedentary lifestyle; Weightless exercise; Smoking; Low estradiol; Elevated prolactin	Low BMI; Loss of height & weight; Previous low calcium intake; Previous fracture; Renal stone disease; Sedentary lifestyle; Low estradiol; Elevated prolactin

* First nations (aboriginal native Canadian).
† NGRI (not guilty by reason of insanity).
‡ Prior to study beginning in 2000.

TABLE 2—*Sex hormone profiles for seven patients treated for paraphilias.*

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Free Testosterone pmol/L*	2.0	2.7	0.9	31	37.9	48.8	31.1
Total Testosterone 10–35 nmol/L	1.2	0.4	NA	8.4	10.6	14.4	5.7
Bioavailable Testosterone 2–8.6 nmol/L	0.09	NA	NA	1.6	2.64	NA	4.08
LH <18U/L	<1.0	15†	37†	16.3	3.9	9.0	4.6
FSH <7U/L	5.6	51‡	47‡	25.2	6.3	10.3	6.7
Estradiol <220 pmol/L	<50	<20	<20	<50	<50	51	<50
Progesterone 0.4–6 nmol/L	0.3	0.8	<1.0	2.4	5.5	1.8	1.8
Prolactin 4–18 mcg/L	5.8	9§	18§	10.6	15.3	22.7	28
Hemoglobin 140–170 g/L	NA	129	127	138	173	138	133¶

* Normal range for free testosterone levels are age- and sex-dependent:
Range for Patients 1,4,5,6: 34–69 pmol/L.
Range for Patient 2: 27–64 pmol/L.
Range for Patient 3: 23–54 pmol/L.
Range for Patient 7: 37–81 pmol/L.
† Range 2–12 IU/L.
‡ Range 1–12 IU/L.
§ Range 0–14 UG/L.
Range 130–180 g/L.
Range 135–170 g/L.
NA = not available.

TABLE 3—*Bone mineral density (BMD) results for seven patients treated for paraphilias.*

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
BMD gm/cm^2 lumbar spine	0.960 (0.958)*	1.079	NA	1.126 (1.129)*	1.136	0.909	0.915
T score	−1.19	−1.1	NA	−0.9 (−0.9)*	−0.9	−2.8	−2.7
Diagnosis†	Osteopenia	Osteopenia	NA	Normal	Normal	Osteoporosis	Osteoporosis
BMD gm/cm^2 femur	0.978 (1.012)*	1.314	0.887	1.123 (1.150)*	0.968	0.910	0.795
T score	−0.36	+1.7	−1.4	+0.4 (+0.6)*	−0.8	−1.2	−2.1
Diagnosis†	Normal	Normal	Osteopenia	Normal	Normal	Osteopenia	Osteoporosis

* 1998 BMD values
† WHO Diagnostic Criteria:
Normal: BMD value (T-score) within 1 SD of young adult mean.
Osteopenia: BMD value (T-score) between −1 and −2.5 SD below the young adult mean.
Osteoporosis: BMD value (T-score) more than −2.5 SD below the young adult mean.
NA = not available.

Patient 1 had osteopenia of the lumbar spine before beginning leuprolide. He had a number of osteoporosis risk factors that may have contributed to this low bone mass including long-term carbamazepine use, a low calcium intake, a sedentary lifestyle, heavy smoking, and long-term high-dose CPA. After one year of etidronate, there was no change in spinal bone mass. While there was some bone mass loss of the femur, it was not severe enough to be classified as osteopenia.

Patient 2 had mild osteopenia despite having substantially reduced testosterone levels since his castration in 1990. Patient 3 has been castrated for 2 years after intermittent CPA use over a ten-year period. He had degenerative changes of the spine and minimal osteopenia of the femur. These two patients had the lowest estradiol levels, although all patients had levels equal to or less than 50 pmol/L. One study, which assessed the relationship between total testosterone, total estradiol, luteinizing hormone levels, and bone mineral density in elderly men, noted that an estradiol value of less than 75 pmol/L was associated with low bone mass (21).

Prior to the initiation of treatment for paraphilias, whether it is in the form of an antiandrogen medication, a GnRH analogue or surgical castration, a thorough medical history, functional inquiry, and physical examination should be done to determine the presence of pre-existing endocrine, liver, cardiovascular, haematological, or renal problems. Recommended blood work should include complete blood count, electrolytes, calcium, phosphate, magnesium, liver function tests, liver enzymes, renal function tests, TSH, and random glucose. A baseline ECG is recommended, particularly if the patient is over the age of 40. A baseline sex hormone profile (free and total

testosterone, estradiol, progesterone, prolactin, LH, and FSH) is also recommended in the assessment of paraphilias in order to rule out medical conditions, which may be associated with paraphilic behavior (1). The baseline also provides a means of comparing future sex hormone results, performed in order to determine compliance with treatment and monitor development of side effects, including anemia, renal impairment, and liver dysfunction (45).

Risk factors for the development of osteoporosis should be reviewed with the patient: smoking history, alcohol use, frequency and type of exercise, dietary intake of calcium and Vitamin D, history of fractures, height and weight (and any loss of height or weight), medication history (use of corticosteroids, anticonvulsants, lithium, heparin), family history of osteoporosis and medical history (history of thyroid disease, diabetes, asthma, bowel disease). A baseline bone densitometry is recommended prior to starting treatment. Thoraco-lumbar spine X-rays are recommended if vertebral fractures are suspected or known or if there is an unexplained loss of height (54).

Once treatment has commenced, or following bilateral orchidectomy, we recommend repeating the bloodwork at six-month intervals. If no abnormalities are noted, this interval may be increased to twelve-month intervals. In the case of those patients who continue to present a significant threat to the safety of the public and therefore remain under a warrant of the ORB (62), the sex hormone profile may be repeated more frequently in order to determine compliance. We repeat the sex hormone profile for those patients on a monthly basis. The men who have been surgically castrated have the sex hormone profile done yearly.

We recommend yearly bone density studies for patients treated with antiandrogen medication or bilateral orchidectomy. Treatment of severe paraphilias, such as exemplified by these seven patients, typically involves long-term therapy and, consequently, long-term androgen suppression. Androgen suppression as a result of surgical castration is obviously irreversible, unless the patient is subsequently treated with exogenous androgens. If bone densitometry reveals osteopenia or osteoporosis, we recommend referring the patient to an endocrinologist to determine treatment options. Cessation of the antiandrogen medication may be an option in the presence of osteoporosis, depending upon the severity and present state of the paraphilia. If the patient's illness has been treatment-resistant or particularly severe, the bone loss may be managed through the use of calcium and Vitamin D supplements as well as anti-resorptive medications such as etidronate (16). Provided there is no underlying problem with calcium or phosphate metabolism, preventative measures may include calcium supplements and Vitamin D supplements, although the efficacy of Vitamin D supplementation in men has not yet been clearly established (16).

Serotonin reuptake inhibitors have been utilized in the treatment of paraphilias to reduce sexual drive, sexual obsessions, and compulsive sexual behavior (58–60). An algorithm for the treatment of paraphilias based upon the severity of the paraphilia suggests that SSRIs be used for mild paraphilias such as the "hands-off" paraphilias, while the antiandrogens and GnRH agonists should be used for severe paraphilias like sexual sadism (61) in which complete reduction of sexual drive and fantasies is desired. However, the decision to use one medication versus another must be based upon the risk posed to the patient by the medication. In the case of Patient 7, the presence of severe osteoporosis and its associated morbidity must be balanced against the risk of sexual reoffending if the CPA was to be discontinued. In the case of those patients under the jurisdiction of the Ontario Review Board (Patients 1, 4–7), which considers the threat the patients pose to the safety of the public in determining whether the patient may reside in the community or must remain in custody in a forensic hospital, any increase in the risk of recidivism may jeopardize community placement or privileges to enter the community.

This paper has reviewed the clinical histories of seven patients treated for severe paraphilias with respect to development of bone loss secondary to androgen suppression. Androgen suppression may result in a number of adverse effects including a spectrum of bone mass loss ranging from osteopenia to osteoporosis. The development of bone loss in such patients is influenced by endocrine factors (testosterone and estrogen deficiencies) as well as the other risk factors commonly associated with osteoporosis (inadequate calcium and Vitamin D intake, smoking, alcohol use, lack of weight-bearing exercise). While it had been thought that medications with progestational action, such as cyproterone acetate, may protect against the development of osteoporosis, this limited clinical case series suggests that even those patients taking CPA should be screened and monitored for osteoporosis. With the introduction of sexually violent predator laws in the United States, the use of antiandrogen medication may play a larger role in the treatment of severe paraphilias, hence the management of such patients should include preventative and treatment strategies for dealing with the bone loss.

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