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INTERNATIONAL
PRADER-WILLI SYNDROME
ORGANISATION

Prader-Willi Syndrome Medical Alerts

by
Medical Specialists in
Prader-Willi Syndrome

PRADER-WILLI SYNDROME

Prader-Willi Syndrome (PWS) is a complex neuro-behavioral genetic disorder resulting from abnormality on the 15th chromosome.
It occurs in male and females equally and in all races.
Prevalence estimates ranges from 1:12,000 to 1:15,000.
Incidence in newborns is unknown.

PWS typically causes low muscle tone, short stature if not treated with growth hormone, cognitive deficits, incomplete sexual development, problem behaviors, and a chronic feeling of hunger that, coupled with a metabolism that utilizes drastically fewer calories than normal, can lead to excessive eating and life-threatening obesity.

At birth the infant typically has low birth weight for gestation, hypotonia, and difficulty sucking due to the weak muscles ("failure to thrive").
The second stage ("thriving too well"), with on set between the ages of two and five throughout lifetime, may show increased appetite, weight control issues, and motor development delay along with behavior problems.

Other factors that may cause difficulties include negative reactions to medications, high pain tolerance, gastro-intestinal and respiratory issues, lack of vomiting, and unstable temperature.

Severe medical complications can develop rapidly in individuals with PWS.

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Revised February 2011

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MEDICAL ALERT - Important Considerations For Routine Or Emergency Treatment

Medical professionals can contact PWSA(USA) to obtain more information and put you in touch with a specialist as needed.

Anesthesia, medication reactions
People with PWS may have unusual reactions to standard dosages of medications and anesthetic agents. Use extreme caution in giving medications that may cause sedation: prolonged and exaggerated responses have been reported.
Anesthesia *- http://www.pwsausa.org/research/anesthesia.htm*

Adverse reactions to some medications
People with PWS may have unusual reactions to standard dosages of medications. Use extreme caution in giving medications that may cause sedation: prolonged and exaggerated responses have been reported. Water intoxication has occurred in relation to use of certain medications with antidiuretic effects (INCLUDING SOME NEUROTROPIC DRUGS), as well as from excess fluid intake alone.
Water intoxication *- http://www.pwsausa.org/support/water_intoxication_alert.htm*

High pain threshold
Lack of typical pain signals is common and may mask the presence of infection or injury. Someone with PWS may not complain of pain until infection is severe or may have difficulty localizing pain. Parent/caregiver reports of subtle changes in condition or behavior should be investigated for medical cause.

Respiratory concerns
Individuals with PWS may be at increased risk for respiratory difficulties, EXPECIALLY DURING INFECTIONS. Hypotonia, weak chest muscles, and sleep apnea are among possible complicating factors. Anyone with significant snoring, regardless of age, should have a medical evaluation to look for obstructive sleep apnea.
Recommendations for Evaluation of Breathing Abnormalities Associated with Sleep in Prader Willi Syndrome *- http://www.pwsausa.org/syndrome/RecEvalSleepApnea.htm*
Respiratory*-http://www.pwsausa.org/syndrome/respiratoryproblems.htm*

Lack of vomiting
Vomiting rarely occurs in those with PWS. Emetics may be ineffective, and repeated doses may cause toxicity. This characteristic is of particular concern in light of hyperphagia and the possible ingestion of uncooked, spoiled, or otherwise unhealthful food items. The presence of vomiting may signal a life-threatening illness.

Severe gastric illness
Abdominal distention or bloating, pain, and/or vomiting may be signs of life-threatening gastric inflammation or necrosis, more common in PWS than in the general population. Rather than localized pain, there may be a general feeling of unwellness. If an individual with PWS has these symptoms, close observation is needed. An X-ray and an endoscopy with biopsy may be necessary to determine degree of the problem and possible need for emergency surgery.
Medical Alert Stomach *- http://www.pwsausa.org/syndrome/medical_alert_Stomach.htm*

Gastroparesis
Another consideration is gastroparesis, a weakness of the stomach that causes delayed stomach emptying. This is a condition that is common with PWS and can be more life threatening then in a typical situation. A child with Prader-Willi syndrome when diagnosed with Gastroparesis may need hospitalization. Eating while the stomach is distended with gastroparesis can be very dangerous. For more information go to: *http://www.gicare.com/pated/ecdgs45.htm*

Body temperature abnormalities
Idiopathic hyper- and hypothermia have been reported. Hyperthermia may occur during minor illness and in procedures requiring anesthesia. Fever may be absent despite serious infection.

Skin lesions and bruises
Because of a habit that is common in PWS, open sores caused by skin picking may be apparent. Individuals with PWS also tend to bruise easily. Appearance of such wounds and bruises may wrongly lead to suspicion of physical abuse.

Hyperphagia (excessive appetite)
Insatiable appetite may lead to life-threatening weight gain, which can be very rapid and occur even on a low-calorie diet. Individuals with PWS must be supervised at all times in all settings where food is accessible. Those who have normal weight have achieved this because of strict external control of their diet and food intake.

Surgical and Orthopedic Concerns
In view of the increasing number of infants and children with PWS undergoing sleep assessments prior to growth hormone treatment and the potential rise in surgical procedures (e.g., tonsillectomy) requiring intubation and anesthesia, it will be important to alert the medical team about complications. These complications may include trauma to the airway, oropharynx, or lungs due to possible anatomic and physiologic differences seen in PWS such as a narrow airway, underdevelopment of the larynx and trachea, hypotonia, edema, and scoliosis.[7]

Musculoskeletal manifestations, including scoliosis, hip dysplasia, fractured bones and lower limb alignment abnormalities, are described in the orthopedic literature. However, care of this patient population from the orthopedic surgeon's perspective is complicated by other clinical manifestations of PWS.

Prader-Willi Syndrome: Clinical Concerns for the Orthopedic Surgeon - *http://www.pwsausa.org/syndrome/Orthopedic.htm*

Guidelines for Postoperative Monitoring of Pediatric Patients with Prader-Willi Syndrome.
http://www.pwsausa.org/syndrome/postoperative.htm

RECOMMENDATIONS FOR EVALUATION OF BREATHING ABNORMALITIES

Associated with Sleep in Prader-Willi Syndrome

PWSA (USA) Clinical Advisory Board Consensus Statement - 12/2003

Problems with sleep and sleep disordered breathing have been long known to affect individuals with Prader-Willi Syndrome (PWS). The problems have been frequently diagnosed as sleep apnea (obstructive [OSA], central or mixed) or hypoventilation with hypoxia. Disturbances in sleep architecture (delayed sleep onset, frequent arousals and increased time of wakefulness after sleep onset) are also frequently common. Although prior studies have shown that many patients with PWS have relatively mild abnormalities in ventilation during sleep, it has been known for some time that certain individuals may experience severe obstructive events that may be unpredictable.

Factors that seem to increase the risk of sleep disordered breathing include young age, severe hypotonia, narrow airway, morbid obesity and prior respiratory problems requiring intervention such as respiratory failure, reactive airway disease and hypoventilation with hypoxia. Due to a few recent fatalities reported in individuals with PWS who were on growth hormone therapy (GH) some physicians have also added this as an additional risk factor.

One **possibility** (that is currently unproven) is that GH could increase the growth of lymphoid tissue in the airway thus worsening already existing hypoventilation or OSA. Nonetheless, it must be emphasized that there are currently no definitive data demonstrating GH causes or worsens sleep disordered breathing. However, to address this new concern, as well as the historically well documented increased risk of sleep-related breathing abnormalities in PWS, **the Clinical Advisory Board of the PWSA (USA) makes the following recommendations:**

1. **A sleep study or a polysomnogram** that includes measurement of oxygen saturation and carbon dioxide for evaluation of hypoventilation, upper airway obstruction, obstructive sleep apnea and central apnea should be contemplated for all individuals with Prader-Willi syndrome. These studies should include sleep staging and be evaluated by experts with sufficient expertise for the age of the patient being studied.

2. **Risk factors that should be considered to expedite the scheduling of a sleep study should include:**

- Severe obesity - weight over 200% of ideal body weight (IBW).
- History of chronic respiratory infections or reactive airway disease (asthma).
- History of snoring, sleep apnea or frequent awakenings from sleep.
- History of excessive daytime sleepiness, especially if this is getting worse.
- Before major surgery including tonsillectomy and adenoidectomy.
- Prior to sedation for procedures, imaging scans and dental work.
- Prior to starting growth hormone or if currently receiving growth hormone therapy.

Additional sleep studies should be considered if patients have the onset of one of these risk factors, especially a sudden increase in weight or change in exercise tolerance. **If a patient is being treated with growth hormone, it is not necessary to stop the growth hormone before obtaining a sleep study unless there has been a new onset of significant respiratory problems.**

Any abnormalities in sleep studies should be discussed with the ordering physician and a pulmonary specialist knowledgeable about treating sleep disturbances to ensure that a detailed plan for

treatment and management is made. Referral to a pediatric or adult pulmonologist with experience in treating sleep apnea is strongly encouraged for management of the respiratory care.

In addition to a calorically restricted diet to ensure weight loss or maintenance of an appropriate weight, a management plan may include modalities such as:

- Supplemental oxygen
- Continuous positive airway pressure (CPAP) or BiPAP
- Oxygen should be used with care as some individuals may have hypoxemia as their only ventilatory drive and oxygen therapy may actually worsen their breathing at night.
- Behavior training is sometimes needed to gain acceptance of CPAP or BiPAP.
- Medications to treat behavior may be required to ensure adherence to the treatment plan.

If sleep studies are abnormal in the morbidly obese child or adult (IBW > 200%) the primary problem of weight should be addressed with an intensive intervention – specifically, an increase in exercise and dietary restriction. Both are far preferable to surgical interventions of all kinds. Techniques for achieving this are available from clinics and centers that provide care for PWS and from the national parent support organization (PWSA-USA). Behavioral problems interfering with diet and exercise may need to be addressed simultaneously by persons experienced with PWS.

If airway related surgery is considered, the treating surgeon and anesthesiologist should be knowledgeable about the unique pre- and postoperative problems found in individuals affected by Prader-Willi syndrome (see "Medical News" article regarding "Anesthesia and PWS" written by Drs. Loker and Rosenfeld in the Gathered View, vol. 26, Nov. – Dec., 2001 or visit: *www.pwsausa.org*).

Tracheostomy surgery and management presents unique problems for people with PWS and should be avoided in all but the most extreme cases. Tracheostomy is typically not warranted in the compromised, ***morbidly obese*** individual because the fundamental defect is virtually always hypoventilation, not obstruction. Self endangerment and injury to the site are common in individuals with PWS who have tracheostomies placed.

At this time there is no direct evidence of a causative link between growth hormone and the respiratory problems seen in PWS. Growth hormone has been shown to have many beneficial effects in most individuals with PWS including improvement in the respiratory system. Decisions in the management of abnormal sleep studies should include a risk/benefit ratio of growth hormone therapy. **It may be reassuring for the family and the treating physician to obtain a sleep study prior to the initiation of growth hormone therapy and after 6-8 weeks of therapy to assess the difference that growth hormone therapy may make.** A follow up study after one year of treatment with growth hormone may also be indicated.

Growth Hormone Treatment and Prader-Willi Syndrome PWSA (USA) Clinical Advisory Board Consensus Statement – 6/2009
http://www.pwsausa.org/GH/index.htm

PWS Growth Hormone Precautions *Update – 2/11*

We advocate a sleep study before the start of growth hormone (GH) on infants, children and adults with Prader-Willi syndrome, and then a follow up study 6-8 weeks later.
If there is worsening of obstructive sleep apnea (OSA) on GH temporarily stopping the GH is recommended until the cause is understood. Frequently the OSA can be corrected by removing the adenoids and tonsils or lowering the dose of GH (in the face of an abnormally high IGF-1). We also recommend taking precautions during bouts of upper respiratory infections.
There are reports and discussion in the medical literature about

adrenal hypofunction in PWS. Single measures of cortisol levels will not be helpful and adrenal challenge tests may be warranted. Please consult an endocrinologist for their input and advice before starting growth hormone treatment.
Infants with PWS, may have gastroesophageal reflux disease (GERD) which causes obstructive hypopneas/apneas, so if an evaluation is positive for GERD, an anti-reflux medication may be prudent before starting GH.
Studies have shown that in most individuals with sleep-disordered breathing due to PWS, GH can actually improve (or at least doesn't worsen) the apnea (Haqq et al, 2004; Miller et al, 2006; Festen et al, 2006). Withholding GH from those with sleep apnea may be detrimental on several levels, thus monitoring the child with PWS closely when starting GH to make sure that they do not worsen is the recommended approach.
The FDA has a statement warning that there could be an increased risk of death associated with GH due to a recent study in France indicating that there may be a slightly increased risk of death in certain individuals treated with GH. PWS is not one of the groups mentioned as being at increased risk - they specifically mention idiopathic short stature and isolated GH deficiency.

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ACUTE GASTROINTESTINAL EPISODES CAN BE LIFE-THREATENING

Janalee Heinemann - Executive Director, PWSA (USA)

I recently received a call from a physician who told me that one of our mother's brought our Medical Alert articles with her to the emergency room. He said, "If she had not brought the articles and insisted I go to your web site, this child would have died. This information saved her life". His patient, a slim 15-year-old, had an episode of binge

eating. She came in with vomiting and belly pain. The physician said normally, she would have treated it like the flu for a couple of days. Due to our alerts, they pursued this further, and found the girl with PWS had such a bad hernia that her spleen, stomach, and duodenum were in her chest. She is now recovering from surgery.

Unfortunately, not all parents carry the articles with them and not all physicians heed our warnings. In another recent situation, a slim young man had an episode of binge eating and the ER and hospital did not take his symptoms serious enough, soon enough. Even though we had one of our physicians called as a consultant and emphasized the urgent need for exploratory surgery, there was a fourteen to sixteen-hour delay in surgery before the local hospital physician believed how life threatening his condition was.

This young man had been doing very well prior to this incident and a few hours after the eating episode, initially only exhibited signs of stomach pain and vomiting. See below for Dr. Rob Wharton's article which was initially printed in The Gathered View in 1998. What Dr. Wharton described was **"acute idiopathic gastric dilation".** This is where part of the stomach tissue dies which is similar to a heart attack where part of the heart tissue dies. It comes on suddenly, is very life threatening and needs immediate surgery. I have been speaking to several people, including our GI specialist, Dr. Ann Scheimann, and the pathologist who did this report with Dr. Wharton (who is now deceased) about the cause. Our conjecture is that if a person with PWS greatly distends their stomach with food (slimmer people may be more at risk) and does not get the normal message of full or pain, they may distend it to the point that it cuts off the blood supply thus causing necrosis. (The stomach becomes blackened and dead.)

Another risk of binge eating that can create a serious medical emergency is GI perforation. In addition, when there is severe stomach pain, a physician should consider an ultrasound due to the possibility of gallstones and pancreatitis. The pancreatitis can be differentiated by chemistry analysis of the blood and a CT of the abdomen.

MEDICAL ALERT:
Stomach Problems Can Signal Serious Illness

Previously published in "The Gathered View", March-April 1998

We have recently recognized and reported* an important medical condition in individuals with Prader-Willi syndrome which families and other care providers should know more about. Although the condition is not common in individuals with PWS, it is much more common in these individuals than in anyone else. It is important to recognize the condition because it can cause severe medical problems when diagnosis and treatment are delayed. The condition can be successfully managed, however, when recognized in a timely fashion.

We have called the condition **acute idiopathic gastric dilatation**. The condition often begins suddenly in individuals in their 20s or 30s. There is generally no known cause. The first symptoms of illness are vague central abdominal discomfort or pain and vomiting. Bloating of the abdomen, caused by swelling or distention of the stomach, may also appear at this time. The person's temperature may also begin to become elevated at this point. In addition, the individual often begins to look and feel quite ill.

Individuals in whom these symptoms appear should *receive immediate medical attention*:

- abdominal pain,
- bloating or distention, and
- vomiting.

A simple X-ray or CT scan of the abdomen should be taken to look for abdominal distention. If abdominal distention is present and the individual has pain but is relatively well appearing, a test called an endoscopy should next be performed to test the person's stomach lining for signs of inflammation. If the individual has distention on X-ray and is quite ill, emergency surgery might be necessary to more closely examine the person's stomach for signs of inflammation and necrosis [death or decay] of the tissue lining the stomach wall. When severe distention and necrosis is present, treatment consists of surgical removal of a significant portion of the stomach.

** Wharton RH et al. (1997) Acute idiopathic gastric dilation with gastric necrosis in individuals with Prader-Willi syndrome. American Journal of Medical Genetics, Dec. 31; Vol. 73(4): page 437-441.*

ANESTHESIA and Prader Willi Syndrome

James Loker, MD, Laurence Rosenfield, MD

Issues Affecting Prader Willi Syndrome and Anesthesia

Individuals with Prader-Willi syndrome may have health issues that alter the course of anesthesia.

• **Obesity** - Obese individuals are more prone to obstructive apnea, pulmonary compromise, and diabetes. Each of these should be taken into account when preparing for anesthesia. The individual may have altered blood oxygen or blood carbon dioxide levels that will change their response to medications including oxygen. Pulmonary hypertension, right-heart failure, and edema may necessitate evaluation by a cardiologist or pulmonologist prior to surgery. An ECG to detect right ventricular hypertrophy may be beneficial to assess pulmonary hypertension. Frequently obese individuals with PWS may have significant body edema (extra fluid) that is not fully appreciated due to obesity. This should be carefully evaluated, and if necessary, diuretics used before and after the anesthesia. Airway management can be a particular problem when conscious sedation is used.

• **High Pain Threshold** - Individuals with PWS may not respond to pain in the same manner as others. While this may be helpful in post-operative management, it may also mask underlying problems. Pain is the body's way of alerting us to problems. After surgery, pain that is out of proportion to the procedure may alert the physician that something else is wrong. Other possible signs of underlying problems should be monitored.

• **Temperature Instability** - The hypothalamus regulates the body's temperature. Because of a disorder in the hypothalamus, individuals with PWS may be either hypo- or hyperthermic. The parent or caregiver can be helpful in letting the anesthesiologist know what the individual's usual temperature is. Although there is no indication of a predisposition to malignant hyperthermia in PWS, depolarizing muscle relaxants (i.e., succinylcholine) should be avoided unless absolutely necessary.

• **Thick Saliva** - A common problem in PWS is unusually thick saliva. This can complicate airway management, especially in cases of conscious sedation or during extubation (when a breathing tube is removed). Thick saliva also predisposes an individual to dental caries (cavities) and loose teeth. Oral hygiene should be evaluated prior to anesthesia.

• **Food-Seeking Behaviors** - It is vitally important that any individual undergoing general anesthesia or conscious sedation have an empty stomach. This reduces the risk of aspiration of the stomach contents into the lungs. Individuals with PWS generally have an excessive appetite and may not tell the truth if they have eaten just prior surgery.

Any individual with PWS should be assumed to have food in the stomach unless it is verified by the caregiver that they have not eaten. A tube may need to be placed in the stomach to assure no food is present prior to attempting to place the breathing tube. Some individuals with PWS may ruminate (regurgitate some of their food) and are at higher risk of aspiration.

• **Hypotonia** - The majority of infants with PWS are significantly hypotonic. This usually improves by 2-4 years of age. The majority, however, continue to have lower muscle tone than normal individuals. This may be a problem in the ability to cough effectively and clear the airways after use of a breathing tube.

• **Skin Picking** - Habitual skin picking can be a significant problem in PWS. This can complicate healing of IV sites and incisional wounds. Usually if these remain well covered, they will be left alone. Depending on the individual's cognitive impairment, restraints or thick gloves may be needed to protect surgical wounds during healing.

• **Hypothyroidism** - Since PWS is a hypothalamic disorder, other hypothalamic functions are at risk. Although the incidence of hypothyroidism in PWS is not known, low levels of thyroid hormone could occur due to lack of thyroid stimulating hormone or thyroid releasing factor, not necessarily due to problems of the

thyroid gland itself. A check of thyroid hormone levels may be beneficial in the preoperative evaluation.

• **Difficult IV Access** - Due to several problems including obesity and lack of muscle mass, individuals with PWS may pose difficulties with insertion of an intravenous line. A stable IV line should be present in any individual undergoing anesthesia.

• **Behavior Problems** - Individuals with PWS are more prone to emotional outbursts, obsessive-compulsive behaviors, and psychosis. They may be on extensive psychotropic medication, and the possible interaction of these medicines with anesthesia should be appreciated.

• **Growth Hormone Deficiency** - All individuals with PWS should be considered growth hormone deficient. The FDA has recently recognized a diagnosis of PWS as an indication for growth hormone therapy. Growth hormone deficiency does not appear to alter cortisol release in response to stress. However, due to reports of central adrenal insufficiency in PWS, the amount of cortisol produced by individuals with this syndrome may not be adequate during times of stress and should be evaluated by your physician.

Recovery Post Anesthesia

Drowsiness after anesthesia may be due to the underlying somnolence and a component of central apnea. For typical outpatient procedures, consideration should be given to an overnight observation.

As mentioned above, a majority of the problems are due to obesity, central and obstructive apnea, but weak muscle tone and chronic aspiration may also play a role in post anesthesia respiratory issues.

Summary

In individuals with PWS, there are health issues that can alter the course of the anesthesia. The majority of the complications do not appear to come from general anesthesia, which is always closely monitored, but from poorly monitored conscious sedation. Only a physician familiar with the patient should make valid medical decisions.

RESPIRATORY PROBLEMS in Prader-Willi Syndrome

James Loker, M.D. Pediatric Cardiologist
PWSA (USA) Clinical Advisory Board Member

Several recent articles continue to show that individuals with Prader-Willi syndrome are at risk for respiratory problems. In particular, problems of central hypoventilation/apnea and obstructive apnea in Prader-Willi syndrome have recently been investigated.

Central hypoventilation is a disorder of decreased breathing rate or depth particularly during sleep. This usually causes problems with daytime sleepiness and if significant can cause problems with elevated blood pressure in the lungs. Individuals with Prader-Willi syndrome may be at increased risk for this due to decreased muscle tone and mass, excessive obesity, and possibly decreased neural drive for breathing. Studies have shown some individuals with Prader-Willi syndrome have decreased depth and rate of breathing.

Central apnea means the complete cessation of breathing during sleep. There are several studies that show an alteration in the response of some individuals with Prader-Willi syndrome to chemicals that would normally increase breathing. Both receptors in the body and the area of the brain that is involved with breathing are being investigated. The clinical significance of central apnea is still under investigation.

Obstructive sleep apnea is well known to occur in Prader-Willi syndrome as well as in other syndromes with hypotonia (poor muscle tone) such as Down syndrome. It is seen in 2% of the normal pediatric population as well. This results when the individual is trying to breathe while asleep, but due to obstruction in the airway, no air enters the lungs. The obstruction can occur anywhere from the nose to the small airway passages in the lungs. These individuals usually have loud breathing and snoring associated with periods of quiet where no air movement is noted. Untreated obstructive apnea can have serious complications including death.

Other problems that can cause respiratory difficulties in the young can be chronic stomach reflux and aspiration. Although the lack of vomiting is felt to be prominent in Prader-Willi syndrome, reflux has been documented and should be investigated in young children with chronic respiratory problems. Individuals with obstructive apnea are at more risk for reflux as well.

The American Academy of Pediatrics has recently set forth guidelines for diagnosis and management of obstructive sleep apnea. The guidelines suggest that all children be screened with history of snoring or other evidence of airway obstruction. Your physician may wish to obtain a sleep study if there is excessive sleepiness, significant obesity or before surgery. In those individuals with a positive history, a sleep study is performed where breathing patterns, heart rate, oxygen levels and air movement are recorded. If the test is positive, further evaluation may need to be performed to individualize the treatment. The primary treatment as suggested by the guidelines would include tonsillectomy and/or adenoidectomy or CPAP (Continuous Positive Airway Pressure), where the individual wears a mask at night to keep the airway open.

Frequently obstructive and central apnea may occur in the same patient. This is probably true in the majority of individuals with Prader-Willi syndrome with respiratory problems. Both obstructive and central apnea can be evaluated by a sleep study. In summary, individuals with Prader-Willi syndrome are at risk for respiratory problems, most commonly obstructive apnea. If any child has symptoms of obstructive apnea, a sleep study should be obtained. The role of central apnea in Prader-Willi syndrome is under investigation.

A special thank you for their contribution to this article goes to:
- Dan J. Driscoll, Ph.D., M.D. PWSA (USA) Clinical Advisory Board Chair
- Merlin G. Butler, M.D., Ph.D. PWSA (USA) Scientific Advisory Board Chair
- David M. Agarwal, M.D. PWSA (USA) Research Advisory Committee Member

Prader-Willi Syndrome: CLINICAL CONCERNS FOR THE ORTHOPEDIC SURGEON

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Introduction: Prader-Willi Syndrome (PWS) is a chromosome 15 disorder characterized by hypotonia, hypogonadism, hyperphagia and obesity. Musculoskeletal manifestations, including scoliosis, hip dysplasia and lower limb alignment abnormalities, are described in the orthopedic literature. However, care of this patient population from the orthopedic surgeon's perspective is complicated by other clinical manifestations of PWS. Osteopenia, psychiatric disorders, and diminished pain sensitivity are frequently noted in PWS but are not discussed in the orthopedic literature. The authors present a clinical review of an 8-year experience caring for 31 patients with PWS to highlight all clinical concerns that influence orthopedic management.

Methods: Thirty-one institutionalized patients diagnosed with PWS were examined and all past medical records were reviewed. Patient demographics, genetic testing, musculoskeletal diagnoses, psychiatric diagnoses, and clinical behaviors were recorded. Radiological studies performed in the course of routine clinical care were evaluated.

Results: Twenty-two men and 9 women, average age 22 years (range 8-39 years), were studied. A chromosome 15Q abnormality was confirmed in 18 patients. Scoliosis was clinically detected in 24 of 31 patients and confirmed by radiographs in 14 of these 24 patients (45% overall with scoliosis) with an average primary curve of 31°; three were braced and 2 underwent spinal fusion. Radiographs also revealed diminished cervical lordosis and

increased cervicothoracic kyphosis in 16 patients, a previously undescribed finding. Hip radiographs of 26 patients revealed dysplasia in 2 patients; no SCFEs were identified. Fourteen patients had sustained a total of 58 fractures with 6 patients sustaining multiple fractures (range 2-7). Bone densitometry was performed on 14 patients; 8 patients had osteopenia and 4 had osteoporosis based on lumbar spine Z-scores. Twenty-six patients had axis I psychiatric diagnoses including impulse control disorder (7) organic personality disorder (6) oppositional defiant disorder (5) dysthymic disorder (4) depressive disorder NOS (3) ADHD (2) and OCD (2). Nine patients exhibited self-mutilating behaviors. Six patients have undergone orthopedic surgical procedures with 1 major complication (spinal infection). Fracture management was associated with frequent minor complications.

Discussion: Osteopenia, poor impulse control and defiant behaviors, and diminished pain sensitivity are aspects of PWS that may complicate all facets of orthopedic non-surgical and surgical management in this patient population. The treating orthopedic surgeon must plan carefully and proceed with caution when treating children and adults with PWS.

(Abstract from the 2003 PWSA (USA) Scientific Conference in Orlando, FL)

Anyone interested in brain tissue donation for research please contact your member association or the Netherlands Brain Bank, Netherlands Institute for Neuroscience, Meibergdreef 47, 1105 BA, Amsterdam, The Netherlands; telephone +31-20-5665499, secretariaatnhb@nin.knaw.nl, www.brainbank.nl

IPWSO
INTERNATIONAL
PRADER-WILLI SYNDROME
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