Orthopedic and Surgical Features in Patients with Prader Willi Syndrome

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DIAGNOSTIC – Major criteria

1. Neonatal and infantile central hypotonia with poor suck, gradually improving with age
2. Feeding problems in infancy with need for special feeding techniques and poor weight gain/ failure to thrive
3. Excessive or rapid weight gain on weight-for-length chart (excessive is defined as crossing two centile channels) after 12 months but before 6 years of age; central obesity in the absence of intervention
4. Characteristic facial features with dolichocephaly in infancy, narrow face or bifrontal diameter, almond-shaped eyes, small-appearing mouth with thin upper lip, down-turned corners of the mouth (3 or more required)
5. Hypogonadism—with any of the following, depending on age:

a. Genital hypoplasia (male: scrotal hypoplasia, cryptorchidism, small penis and/or testes for age [<5th percentile]; female: absence or severe hypoplasia of labia minora and/or clitoris)

b. Delayed or incomplete gonadal maturation with delayed pubertal signs in the absence of intervention after 16 years of age (male: small gonads, decreased facial and body hair, lack of voice change; female: amenorrhea/oligomenorrhea after age 16)

6. Global developmental delay in a child younger than 6 years of age; mild to moderate mental retardation or learning problems in older children
7. Hyperphagia/food foraging/obsession with food
8. Deletion 15q11–q13 on high resolution (>650 bands) or other cytogenetic/molecular abnormality of the Prader-Willi chromosome region, including maternal disomy

DIAGNOSTIC - Minor Criteria

1. Decreased fetal movement or infantile lethargy or weak cry in infancy, improving with age
2. Characteristic behavior problems—temper tantrums, violent outbursts and obsessive/ compulsive behavior; tendency to be argumentative, oppositional, rigid, manipulative, possessive, and stubborn; perseverating, stealing, and lying (5 or more of these symptoms required)
3. Sleep disturbance or sleep apnea
4. Short stature for genetic background by age 15 (in the absence of growth hormone intervention)
5. Hypopigmentation—fair skin and hair compared to family
6. Small hands (<25th percentile) and/or feet (<10th percentile) for height age
7. Narrow hands with straight ulnar border
8. Eye abnormalities (esotropia, myopia)
9. Thick, viscous saliva with crusting at the corners of the mouth
10. Speech articulation defects
11. Skin picking

DIAGNOSTIC - Supportive findings

1. High pain threshold
2. Decreased vomiting
3. Temperature instability in infancy or altered temperature sensitivity in older children and adults
4. Scoliosis and/or kyphosis
5. Early adrenarche
6. Osteoporosis
7. Unusual skill with jigsaw puzzles
8. Normal neuromuscular studies

DIAGNOSTIC

Time period when clinical manifestations fi rst appear	Clinical manifestation	Affected patients (%)
Pregnancy and delivery	Reduced fetal activity	**76**
	Nonterm delivery	**41**
	Breech presentation	**26**
Neonatal and infancy	Delayed milestones	**98**
	Hypogenitalism/hypogonadism	**95**
	Hypotonia	**94**
	Feeding problems	**93**
	Cryptorchidism	**88**
	Narrow bifrontal diameter	**75**
	Low birth weight (<2.27 kg)	**30**
Childhood	Mental deficiency	**97**
	Obesity	**94**
	Small hands and feet	**83**
	Skin picking	**79**
	Short stature	**76**
	Almond-shaped eyes	**75**
	Strabismus	**52**
	Delayed bone age	**50**
	Scoliosis	**44**
	Personality problems	**41**
	Early dental caries/enamel Hypoplasia	**40**
Adolescence and Adulthood	Menstruation	**39**
	Reduced glucose tolerance/diabetes mellitus	**20**
	Seizures	**20**

Butler MG. Management of Prader-Willi Syndrome. Third Edition

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Neonatal and infancy

CONDITION	THERAPY
Weak suck reflex	Medical / behavior terapy (adaptive devices, positioning strategies, jawstrengthening exercises, thickening agents for liquids, and use of low calorie binding agents)
Lack of coordination between suck/swallow	
Lack of adequate salivation	
Micrognathia and microdontia	
Severe failure-to-thrive	
Feeding difficulties	Nasogastric tube feeding/ **gastrostomy**
Poor weight gain and slow physical growth	

Neonatal and infancy

CONDITION	THERAPY
Hip displasia	Pavlik harness Becker harness Cast Medical gymnastics Bracing Surgery
Limb malalignment	
Scoliosis	

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Early childhood

CONDITION	THERAPY
Hypogenitalism/hypogonadism Cryptorchidism (>90%)	Gonadotrophin 500–1000 U by intramuscular injection twice a week for 5 weeks ?
Lack of adequate salivation	Post-test testosterone level of >100–200 ng/dL is indicative of testicular activity
Micropenis Inguinal hernia can occur in >90% of cases	Spontaneous descent of a cryptorchid testicle may occur
Feeding difficulties Hypoplasia of the clitoris and/or labia minor	Surgical exploration and orchidopexy

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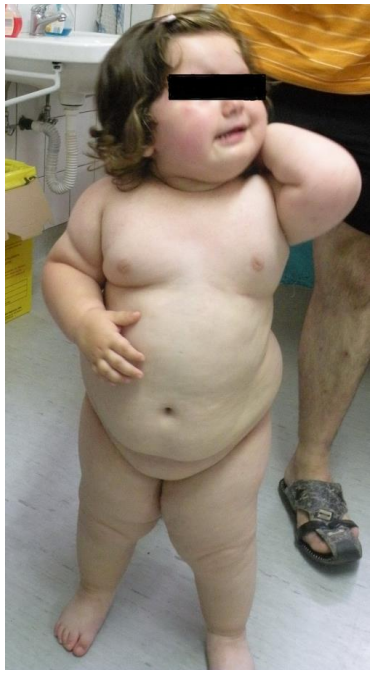
Orchidopexy

- Reduces the risk for cancer
- Reduces the risk for testicular torsion
- Preserve the testicular function and fertility

Early childhood

CONDITION	THERAPY
Obesity 	Behavioral Modification Diet Exercise Medical therapy Surgery

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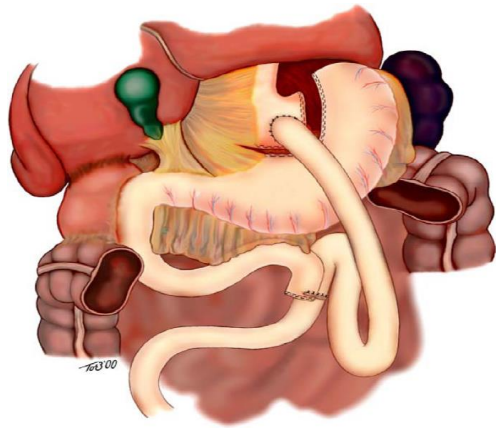
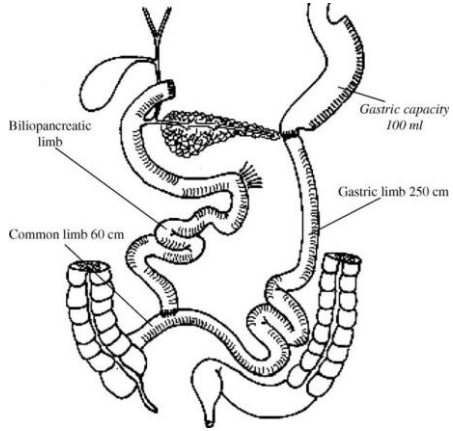
Surgery for Obesity

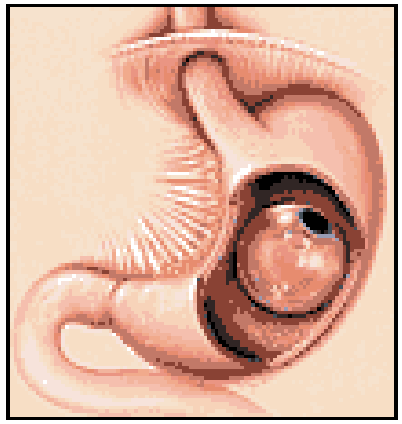
Indication for surgery	Procedure
BMI > 40	Roux-en-Y Gastric Bypass
BMI > 35 with co-morbidities	Bilio-pancreatic diversion
High rate of complications	Gastric banding
	Vagotomy
	Gastroplasty
	Jejuno-ileal bypass
	Intragastric balloon

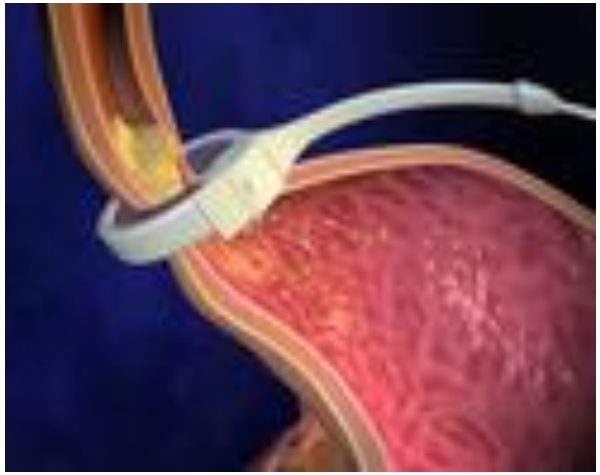
Not recomended as routine treatment for children and teenagers

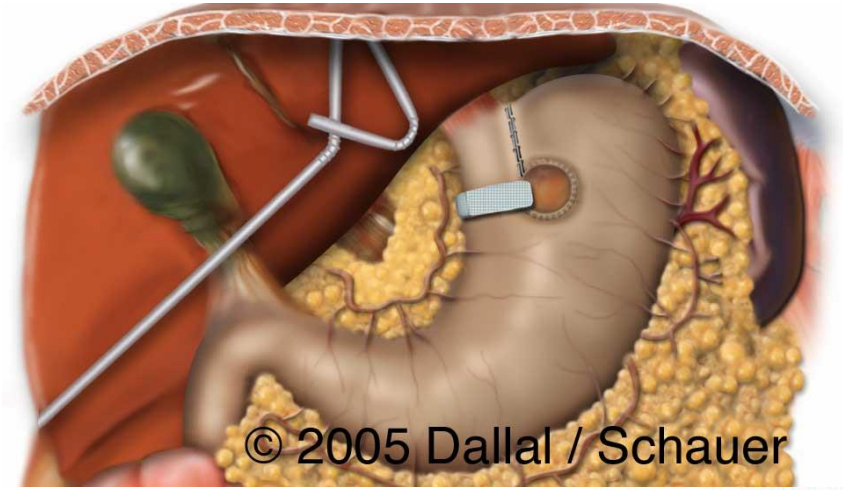
Surgery for Obesity











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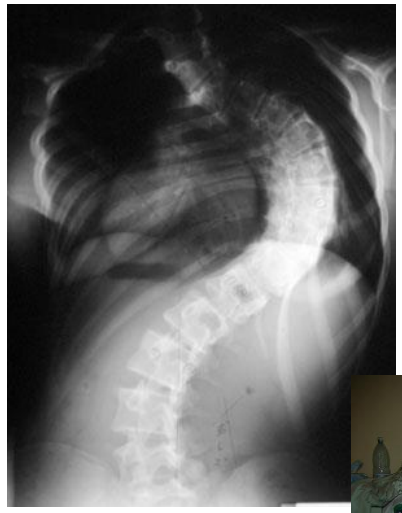
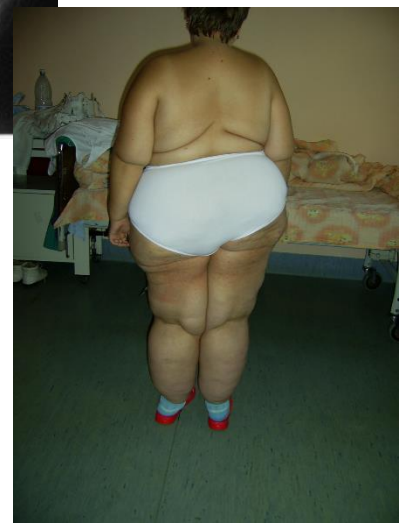
Other surgical conditions

- Abdominal and rectal pain, rectal fissures, hemorrhoids, and rectal bleeding
- Diarrhea is more frequently than constipation in PWS
- Skin picking – skin lesions – skin infection
- Rectal ulcers - regional skin picking

Scoliosis

- > 45% of PWS
- Pathogenesis - neuromuscular imbalance
- Abnormal kyphosis or lordosis
- Majority = mild/ moderate Cobb angle < 25^0





Scoliosis

- Physical therapy = 90%
- Clinical screening and serial spine radiographs
- Bracing
- Surgery (Cobb > 45^0)

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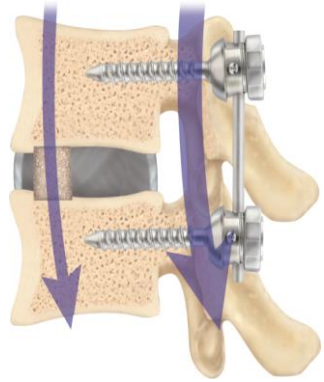
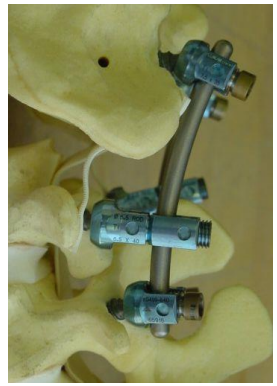
Surgery for scoliosis

- ↑trained specialists
- ↑costs
- ↑costs
- ↓results
- < 10% of cases (Timisoara < 5 cases/ year)





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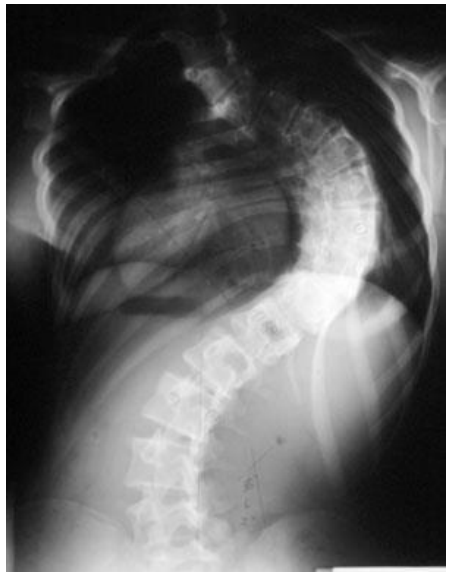
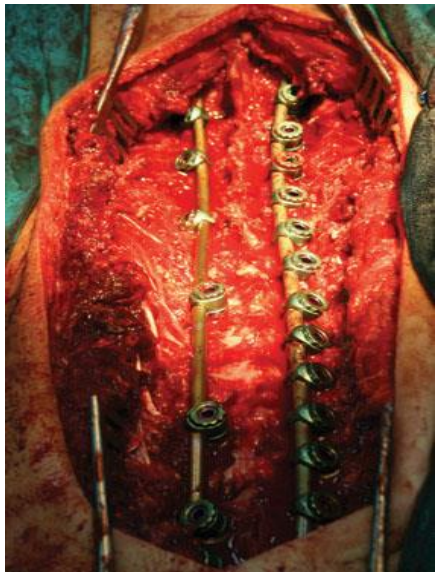
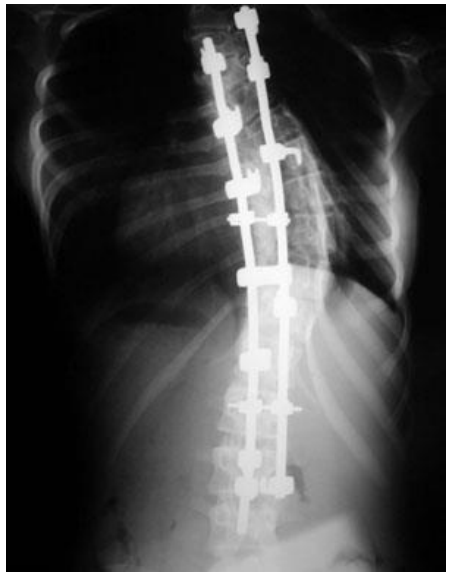
Surgery for scoliosis







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Musculoskeletal Disorders

- Small hands and feet
- Short stature

→ Growth hormone

- Delayed bone age
- Osteoporosis

→ Pathologic fractures
→ Limb malaligment
→ Walking difficulties

→ Regular exercise
Control of the obesity
Physical therapy
Estrogen replacement
Bisphosphonate
Growth hormone

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Conclusions

- There are numerous conditions that require the intervention of the surgeon in the multidisciplinary approach of the patients with PWS
- All patients with confirmed or suspected PWS should be evaluated for cryptorchidism, hip dysplasia and limb malalignment during neonatal period
- Children with PWS should be regularly screened for abnormal bone structure and back curvature.
- When diagnosed early, scoliosis may be managed by nonsurgical means
- Surgical control of the obesity should be considered only in extreme cases and only after all other therapeutically means were wasted

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THANK YOU

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