Case Number 3
Prune Belly Syndrome aka Eagle-Barrett Syndrome

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Case summary:

HM, male

Severe bilateral hydronephrosis was noted at 20 weeks gestation with normal liquor at the time. The baby was delivered by elective C-section at 39 weeks gestation and very little liquor was noted. He was noted to have deficient abdominal wall musculature and cryptorchidism and prune-belly syndrome was suspected. A renal US confirmed bilateral severe hydroureteronephrosis with no evidence of posterior urethral valves or vesico-ureteric reflux on micturating cystourethrogram. A DTPA scan excluded outflow tract obstruction and a DMSA scan showed a non-functioning left kidney. His creatinine was noted to be 228umol/l (normal creatinine at this age 20-30umol/l). An ultrasound of the brain and back revealed no spinal anomalies and an echocardiogram showed a normal heart. Over the first few months of life he was managed conservatively on medications for chronic kidney disease. At the age of 1 year he underwent a left orchidopexy and a right first stage Fowler Stephen's procedure. The second stage was performed a few months later.

Presenting complaint:

Patient admitted to undergo left open nephrectomy.

History of presenting complaint:

HM presented a few weeks earlier, at 18 months of age, with a pyonephrosis of his non-functioning left kidney. A left nephrostomy was urgently performed to drain the pus. He received 2 weeks of intravenous antibiotics and was readmitted for a left nephrectomy.

Past medical and surgical history:

Past medical history:
Chronic kidney disease, Stage 4 (baseline creatinine 180umol/l).
Gastro-oesophageal reflux

Past surgical history:
Left orchidopexy, right first stage Fowler Stephen's procedure, circumcision (February 2014).
Second stage right Fowler Stephen's procedure complicated by acute kidney injury secondary to acute urinary retention from right ureteric obstruction. Right ureterostomy performed (August 2014).

Drug history:

Drug	Dosage	Frequency	Type	Reason
Calcium carbonate	120mg (2mls)	Four times a day	A dietary supplement	To maintain electrolyte balance
Sodium bicarbonate	5mmols	TDS	Antacid	Reduces stomach acid
Sodium chloride	4mmol	BD	A dietary supplement	To maintain electrolyte balance
Ranitidine	12mg (0.8mls)	TDS	Histamine-2 blocker	To reduce the amount of acid in the stomach
Sytron	3mls	BD	A dietary supplement, to increase levels of iron	The increase in iron stimulates erythropoiesis
Alfacalcidiol	300nanog	Daily	A dietary supplement, an analogue of vitamin D	To increase the levels of calcium.
EPO beta	500 units	Weekly	A recombinant form of erythropoietin and therefore stimulates erythropoiesis	To stimulate erythropoiesis
Co-amoxiclav	78mgs nocte	Four – six times a day	Anti-biotic	To treat any urinary tract infections

No known drug allergy.

Family history:

No relevant renal or other problems.

Social history:

Lives at home with his two parents.

Systemic inquiry:

- General Health: Nil to note
- Cardiovascular System: Nil to note
- Respiratory System: Nil to note
- Gastrointestinal System: Nil to note
- Genitourinary System: As discussed above
- Central Nervous System: Nil to note
- Musculoskeletal System: Weak abdominal muscles
- Endocrine System: Nil to note
- Others: Nil to note

On examination:

- Afebrile
- Heart sounds S1 and S2
- Clear chest

- Abdomen soft, weak abdominal musculature, non-tender – left nephrostomy clean, not erythematous, right ureterostomy pink, healthy mucosa. No organomegaly. Bowel sounds normal.
- Genitalia normal male, testes both in scrotal sac.

Discussion of general and specific examination:

The report illustrates the case of an 18 month old boy who was noted to have bilateral hydroureteronephrosis antenatally which was confirmed post-natally. The presence of deficient abdominal wall musculature, cryptorchidism and renal problems led to the suspicion of prune belly syndrome. He required bilateral orchidopexy as well as a circumcision to minimise urinary tract infections. The non-functioning left kidney was complicated by a pyonephrosis and required urgent removal. His creatinine improved in the first months of life, as is the norm as the kidneys mature, and settled at 180umol/l (chronic kidney disease stage 4). Optimisation of nutrition and medical correction of biochemical abnormalities will help to ensure normal growth and development.

Differential diagnosis of antenatal bilateral hydronephrosis:

- Bilateral vesicoureteric reflux
- Posterior urethral valves in males
- Bladder outlet obstruction
- Megacystis microcolon intestinal hypoperistalsis syndrome[1]

Major Causes of Antenatal Renal Tract Dilatation[2]

• Transient hydronephrosis (normal postnatal scan)	50%
• Hydronephrosis with no evidence of obstruction; or extrarenal pelvis	15%
• PUJ obstruction	11%
• VUR	9%
• Megaureter (obstructed, refluxing, non-refluxing and non-obstructed or both refluxing and obstructed)	4%
• Renal dysplasia	3%
• MCDK	2%
• Duplex kidney +/- ureterocoele	2%
• PUV	1%
• Others	5%

Diagnostic procedures:

Test: Bloods

Haemoglobin	9.5 g/dl to detect anaemia of chronic disease
Haematocrit	30 %
White cell count	11.5 $x10^9$/l
Neutrophils	7.2 $x10^9$/l
Lymphocytes	3.16 $x10^9$/l
Reticulocytes	42.5 $x10^9$/l
Platelets	208 $x10^9$/l
Ferritin	120 ng/ml (28-365) to assess iron stores in CKD

Sodium	134 mmol/l
Potassium	4.99 mmol/l to exclude hyperkalaemia in CKD
Chloride	100.9 mmol/l
Urea	14.9 mmol/l to exclude uraemia
Creatinine	166 umol/l biomarker for renal function
Bicarbonate	22.4mmol/l to exclude acidosis
Bilirubin	2.4 umol/l (1.72-17.1)
Gamma glutamyl transferase	9 U/L (8-61)
ALT	9 U/L (5-41)
Alkaline phosphatase	167 U/L (0-300) to assess bone mineral disorder
Albumin	44.9 g/l (34-48)
Calcium	2.58mmol/l (2.15-2.55) to assess bone mineral disorder
cCalcium	2.48 mmol/l (2.05-2.6)
Phosphate	1.92 mmol/l (0.87-1.45) to assess bone mineral disorder
Magnesium	0.99 mmol/l
PTH	107+ pg/ml (15-65) to assess bone mineral disorder
Total 25 (OH) Vitamin D	51 ng/ml to assess bone mineral disorder

Imaging Tests:

Test: Ultrasound in utero
Justification for test: To detect congenital defect.
Result: Left kidney: Grade IV hydronephrosis with cortical thinning 1.5mm with no hydroureter. Right kidney with grade III hydronephrosis with megaureter down to urinary bladder. No ureterocoele identified. Bladder contains moderate amount of fluid. No free fluid.
Conclusion: patient has antenatal bilateral hydronephrosis.

Test: Ultrasound Scan of kidneys
Justification for test: To confirm congenital defect detected antenatally.
Result: The left kidney has a thin cortical rim and severe hydroureteronephrosis The right kidney has a prominent collecting system, however the APPD has diminished and now measures 0.8cm (previously 1.9cm). No hydroureter is seen. The urinary bladder is empty and heavily trabeculated.
Conclusion: Right kidney improved. Left kidney unchanged.

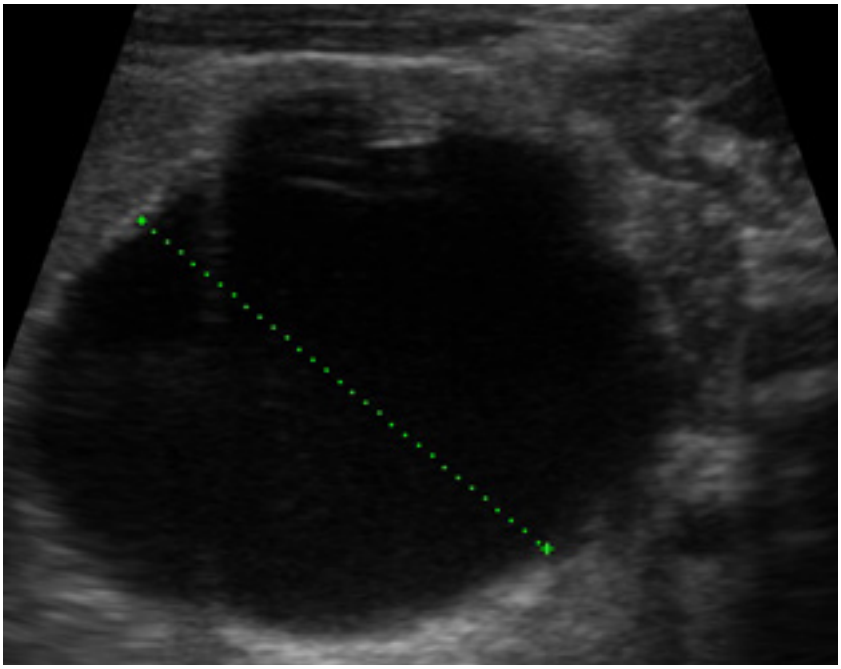

Figure 1: Ultrasound scan showing left hydronephrosis with increased antero-posterior pelvic diameter (APPD).

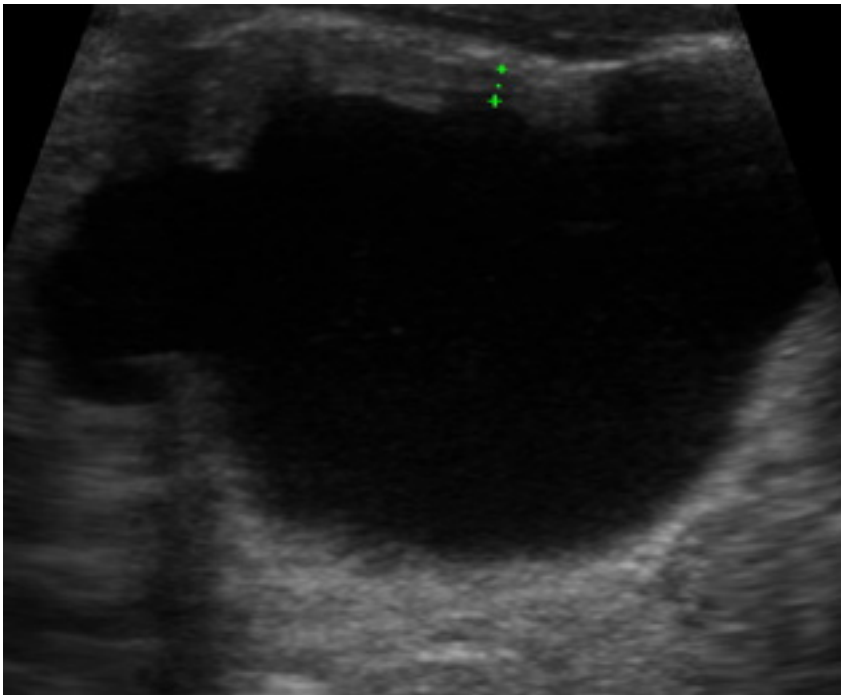

Figure 2: Ultrasound scan showing left hydronephrosis with increased antero-posterior pelvic diameter (APPD).

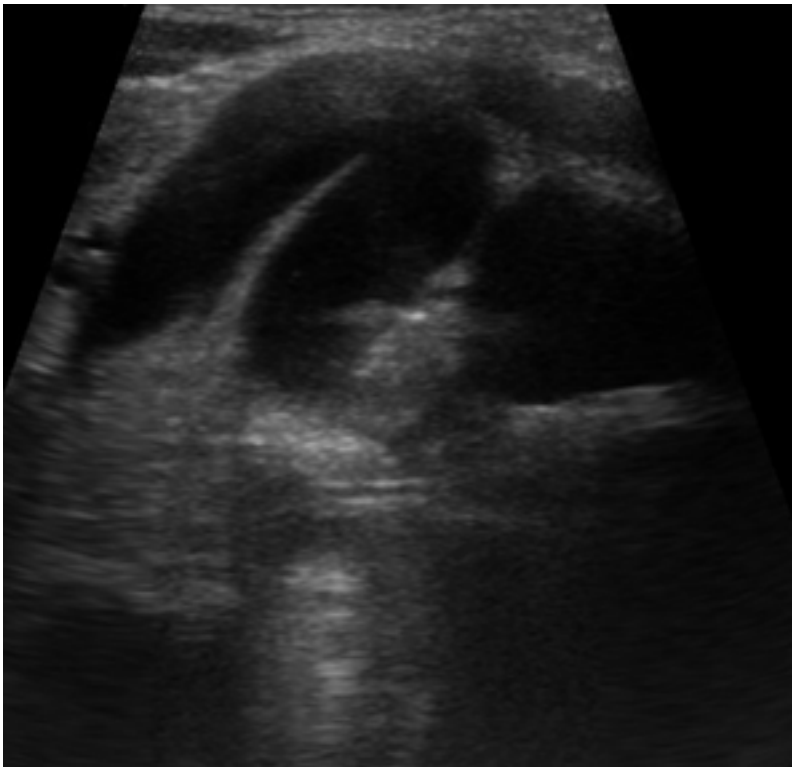

Figure 3: Ultrasound scan showing dilated and tortuous right ureter.

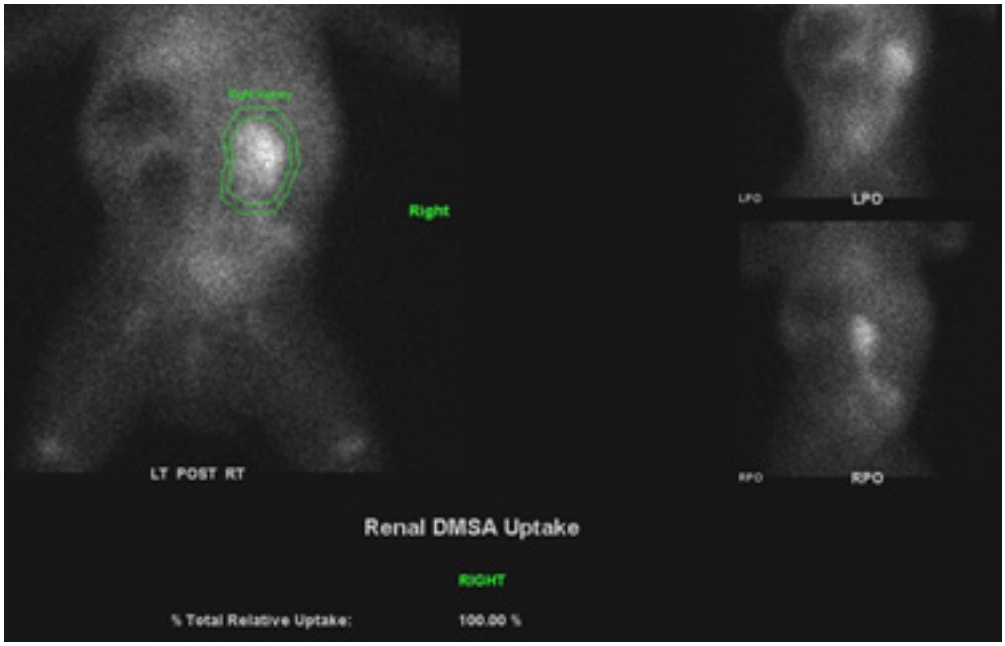

Figure 4: DMSA scan showing single functioning right kidney

Test: Micturating Cystourethrogram
Justification for test: To investigate the anatomy of the bladder and urinary tract, in particular to detect reflux into the upper tracts, exclude posterior urethral valves and bladder wall anomalies.
Result: There is no evidence of active or passive reflux.The urinary bladder is enlarged and elongated. There are no trabeculations or evidence of urachal diverticulii. No evidence of bladder neck hypertrophy is observed. No urethral strictures or urethral irregularities in the region of the external sphincter are present. On micturition the prostatic urethra dilates slightly but there is no evidence of posterior/anterior urethral valves. Incidental note is made of a normal prostatic utricle.
Conclusion: No evidence of posterior urethral valves or reflux. Overall findings are more compatible with prune belly syndrome.

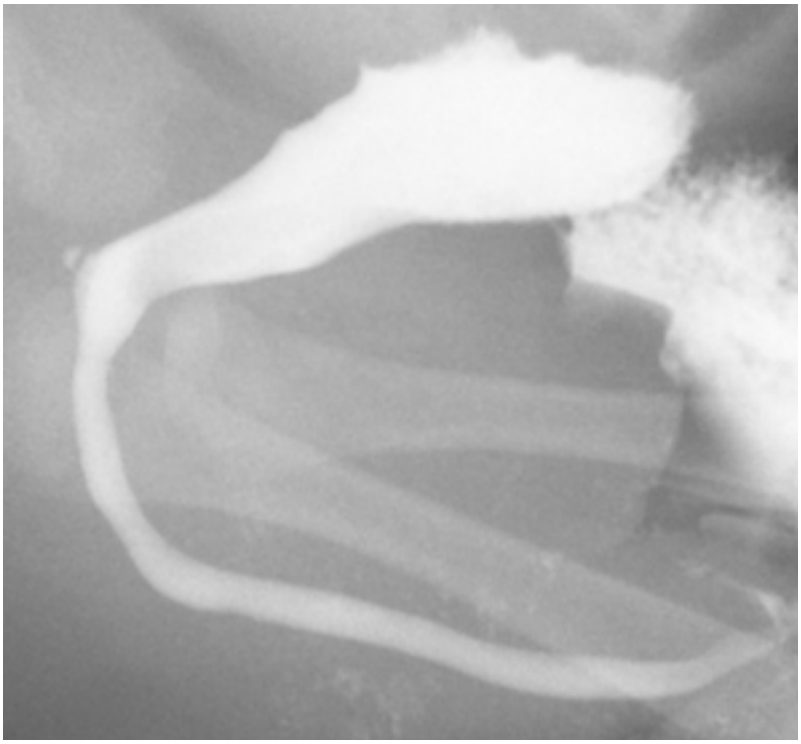

Figure 5: MCUG showing normal posterior urethra

Test: Chest X ray
Justification for test: To look for any abnormalities in the chest.
Result: Bell-shaped chest wall.
Conclusion: Part of the syndrome.

Test: US brain
Justification for test: to look for any associated abnormalities.
Result: Normal.
Conclusion: No associated brain anomaly.

Test: Echocardiogram
Justification for test: to exclude a cardiac anomaly.
Result: Normal.
Conclusion: No associated cardiac anomaly.

Test: NM DTPA Scan
Justification for test: To exclude outflow tract obstruction and get a measure of GFR.
Result: Kidneys in situ. Right kidney of normal size and morphology, with inhomogeneous tracer uptake

in the cortical phase. There is marked stasis in the collecting system with good washout following administration of diuretic. The left kidney shows a minimal amount of functioning tissue and outflow tract and therefore cannot be evaluated.
Conclusion: There is high background activity throughout the study suggestive of renal failure.

Test: US of testes
Justification for test: To assess the testes.
Result: The left testis is located at the superficial inguinal ring, however it could not be advanced further than this and was seen to easily spontaneously reduce back into the inguinal canal. The right testis was not identified in the scrotum or inguinal canal, however an ovoid structure of identical echogenicity located between the right side of the bladder and the distended distal right ureter is felt to represent an intra-abdominal testis.
Conclusion: Both testes are undescended.

Test: US of the spine
Justification for test: To exclude spinal anomalies.
Result: The cord terminates at L2 level. The visualised cord, conus medullaris and cauda equina roots are within normal limits. There is no evidence of tethering of the spinal cord or thickening of filum terminale. There is no evidence of a spinal lipoma.
Conclusion: Examination is within normal limits.

Diagnosis:

A diagnosis of Prune belly syndrome was made based on the following signs found during investigations; hydronephrosis found on ultrasound, bell-shaped chest wall found on chest x-ray and cryptorchidism also found on ultrasound.

Final treatment and follow ups:

The child will be continued on ciprofloxacin orally for three days and his EPO will be increased to twice a week. He will be followed up at the pediatric day care by the nephro-urological team.

Fact Box 3:

Name of Condition: Prune Belly Syndrome

Prune Belly Syndrome also known as Eagle-Barrett syndrome or triad syndrome[3]. It is a collection of birth defects involving:

- Poor development of abdominal musculature[4]. This can lead to a poor cough mechanism which will lead to increased pulmonary secretions. The weak musculature may also lead to constipation due to inability to perform the Valsalva maneuver[3]. This may be due to a partial or complete absence of the abdominal muscles[5].
- Cryptorchidism[4], usually bilateral[5]
- Urinary tract abnormalities[4]. Obstruction or upper urinary tract dilation can occur, with the site varying from the pelviureteral junction to the prostatic membranous urethra[3]. The malformations may include dilatation of ureters, hydroureter, hydronephrosis or vesicoureteral reflux[5].

The cause of prune belly syndrome is unknown and affects mostly males. In utero, the fetus' abdomen swells, usually due to a urinary tract abnormality. This fluid disappears after birth resulting in a wrinkled abdomen. This is made more noticeable by the lack of abdominal musculature[4]. Complications include pulmonary hypoplasia and chronic kidney disease[5]. Oligohydraminos in pregnancy can cause lung problems[4].

The mortality rate associated with this syndrome is 20%. The severity of this syndrome varies from patient to patient. No definitive treatment has yet been established[4]. However early surgery to fix weak abdominal muscles, urinary tract problems and cryptorchidism is recommended. Antibiotics may be given to treat or prevent UTIs[4]. It affects 1 in 30,000-40,000 live births, with 96-97% of all cases being males. Twinning is associated with this syndrome, with 4% of all cases being twin pregnancies. It is also associated with trisomy 18 and 21. There is an increased incidence of tetralogy of Fallot and ventriculoseptal defects[3].

Woodhouse et al. (1982) reviewed 47 cases of prune-belly syndrome. They reported varying degrees of abdominal muscle weakness, leading to 'pseudo-prunes'. However these cases still had urinary tract problems. A similar but rarer condition in girls exists. Although the exact cause is not yet known, a two-step autosomal dominant mutation with sex-linked expressions, partially mimicking X-linkage has been suggested. The syndrome has a broad spectrum and so management is disputed. Prognosis depends on the condition of the kidneys at birth, and so classification is useful for management[6].

Weber et al. (2005) discusses the genetic component in posterior urethral valves/prune-belly syndrome (PUV/PBS). The exact etiology of PUV is not yet understood, however population studies suggest a genetic factor. In fact we see a higher incidence of PUV in populations with elevated background rate consanguinity. In one family that had six children, the parents and the one daughter were normal while the boys were all affected. This suggests that the condition is X-linked recessive. The disease might also be digenic, this might explain the low incidence even in siblings since you need both defective genes in order to explain the phenotype[7].

Risk Factors:

- Male gender
- Young maternal age
- Use of herbal concoctions in pregnancy[8]

Symptoms and signs:

Weak abdominal muscles can cause:

- 'Little Buddha' appearance
- Constipation
- Delay in sitting and walking
- Difficulty coughing

Urinary tract problems can lead to difficulty urinating[4].

Investigations to confirm diagnosis:

Ultrasound during pregnancy may show a swollen bladder or enlarged kidney

After birth:

- Blood tests
- Ultrasound
- Voiding cystourethrogram
- X-ray[4] of the chest

Prevention

There is no known prevention for this condition. In rare cases, surgery during pregnancy can be performed after diagnosing a urinary tract obstruction to help prevent progression to prune belly syndrome[4].

References:

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