Potter’s Syndrome associated with Pouch Colon Anomaly in Exomphalos

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Abstract
Potter’s Syndrome is a rare congenital malformation which is an atypical physical appearance of the foetus or neonate due to Oligohydramnios experienced in the womb with distinctive facial characteristics. Oligohydramnios is the cause of the various deformities observed in Potter’s Sequence. It is characterised by bilateral renal agenesis, pulmonary hypoplasia, and skeletal defects of the neonate as a direct result of lack of amniotic fluid.

Congenital pouch colon (CPC) is an extremely rare variant of anorectal malformation (ARM), in which varying lengths of the colon is replaced by a dilated pouch accompanied by a fistula communicating with the genitourinary tract.

Complete Penoscrotal Transposition (CPST) is a rare and unusual malformation in which the scrotum is located cephalic to the penis. It is associated with major and often life threatening malformations.

The present case has multiple malformations which include, potter’s syndrome, congenital pouch colon in omphalocele and complete penoscrotal transposition. The aim of this study was to determine the incidence, prevalence of these multiple malformations according to anatomical localization. This complex anomaly is very rare and interesting. Survival is extremely rare. In view of prognosis early diagnosis allows for earlier and less traumatic therapeutic abortion.

Keywords: Potter’s sequence; Congenital pouch colon (CPC); Congenital penoscrotal transposition (CPST); Anorectal malformation (ARM)

Introduction
Edith Potter, the pioneer in the field of human renal development, analysed 5000 autopsies on foetuses and new born infants over a period of 10 years. She was able to deduce the sequence of events that lead to Potter sequence. In 1946, she described the facial characteristics of infants with bilateral renal agenesis and pulmonary hypoplasia as a result of oligohydramnios due to compression in utero. Potter syndrome is fatal, incompatible with extra uterine life and 33% of foetuses die in utero.

Congenital pouch colon is commonly known as congenital short colon. This rare anomaly is counted with anorectal malformations (ARM). It is to be considered especially during the clinical evaluation of the children with cloacal malformations and anorectal anomalies. The pathogenesis and embryology of CPC are not well understood. It may be due to dietary, environmental factors and familial inheritance.

We report a rare variant of Potter sequence associated with congenital pouch colon in the omphalocele and penoscrotal transposition. These multiple malformations have not been reported in the literature. A number of abnormalities can add to morbidity and mortality in this case.

A still-born male foetus has been collected from the Department of OBG, KIMS, Narketpally during the month of October, 2011. After written consent was obtained from the parents, full autopsy examination was done.

Case Report
A 21 years primigravida, presented to the Dept of Gynaecology, Kamineni Hospital, Narketpally with 34 weeks of gestation, diagnosed with severe oligohydramnios and intra-uterine death of the male foetus by antenatal Ultrasoundography. Medical termination of pregnancy was done.

A detailed autopsy examination was undertaken and gross and microscopic examination was done in the Department of Anatomy.

Observations: Study of the aborted foetus

External features: Weight - 1.6 kg
Crown to heel - 16 cm
Head circumference - 12 cm
Chest circumference - 10 cm
Crown to rump - 11 cm
Abdominal circumference - 10 cm

Typical Potters facies with skin fold extending from medial canthus across the cheek, redundant skin, flattened nose and low set large ears (Figures 1 and 2).

Limb anomalies - Absent right thumb and hyper extended left thumb (Figures 3 and 4).

Omphalocele present in the umbilical cord (Figure 5). External genitalia present penoscrotal transposition with empty scrotum (Figure 6). Anal orifice was absent (Figure 7).

Internal Features: Brain - Normal

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Thoracic region - The Heart was normal and the lungs were hypoplastic (Figure 8).

GIT: Stomach, liver, spleen and small intestine were normal.

Large intestine: Large intestine beyond caecum was converted into a blind sac known as pouch colon, with caecum and appendix outside the pouch colon. The pouch colon is presented as omphalocele (Figures 9-11). Genitourinary system: Bilateral Renal agenesis with agenesis of ureters and urinary bladder (Figures 12 and 13). Bilateral undescended testis present in the lumbar region (Figures 12 and 14). Entire pelvic cavity was empty. Umbilical cord presents a dilated blind sac called pouch colon. It presents a single umbilical artery and a single umbilical vein (Figures 15 and 16). Placenta shows intervillosus fibrinoid necrosis with syncytial knots (Figures 17 and 18).

Discussion

Potter’s sequence also known as Potter’s syndrome or Oligohydramnios sequence is the atypical physical appearance of a foetus or a neonate due to oligohydramnios experienced in the womb. Oligohydramnios causes disruptions in morphogenesis of the foetus [1].

It is characterised by bilateral renal agenesis, pulmonary hypoplasia, limb defects of the neonate as a direct result of lack of amniotic fluid. It is found in 0.2% to 0.4% of the autopsies performed on stillborn infants. There is no treatment available currently and they have a very poor prognosis with the respiratory distress which is the leading cause of death. Potter’s facies is considered as typical wide set eyes, squashed nose, receding chin, prominent epicanthic folds and large low set ears.

In 1946, Dr. Edith Potter reported the necropsy findings of 20 infants dying in the perinatal period with bilateral renal agenesis [2]. Potter sequence has been defined into five distinct sub classifications

Type I is due to autosomal recessive polycystic kidney disease (ARPKD) which occurs at a frequency of approximately 1 in 16000 infants.

Type II is usually due to renal agenesis, which can also fall under the category known as hereditary urogenital adysplasia. This is characterized by the complete agenesis or absence of one kidney.
Type III is due to Autosomal dominant polycystic kidney disease (ADPKD) linked to mutations in the genes PKD1 and PKD2.

Type IV occurs when a long standing obstruction in either the kidney or ureter leads to cystic kidneys or hydronephrosis.

It has been estimated to occur at a frequency of approximately 1:4000 to 1:8000 foetuses and neonates. No racial predilection is known.

This condition has been reported to occur twice as common in males as in females. In males the testes will begin to form at the same time the kidneys do, whereas in females the ovaries begin to form after the kidneys.

Al-Haggar M et al. [3] reported one foetus of sirenomelia sequence with Potter’s syndrome which showed oligohydramnios and symelia Apus. The infant showed absent urinary tract and external genitalia, the legs were fused by skin and had separate bones associated with Potter’s syndrome. The mother had a history of gestational diabetes mellitus.

Genetics

During nephrogenesis, multiple genes, transcription factors and growth factors control the essential interaction between the ureteric bud and the metanephric mesenchyme. LIM1 and PAX2 transcription factors are essential for the formation of the mesonephric duct, from which ureteric bud develops. LIM1-deficient individuals have complete renal agenesis [4].

The index case presents a male foetus of type II classification, a classic Potter sequence with pulmonary hypoplasia and absence of thumb and associated Congenital pouch colon (CPC) present in umbilical cord. It also presents congenital penoscrotal transposition (CPST) and single umbilical artery.
Potter syndrome coexists with CPC and penoscrotal transposition has not been reported in the literature. Congenital pouch colon associated with anorectal malformations is an extremely rare variant in which part of the colon is replaced by a pouch like dilatation [5]. They are divided into four types [6]:

**Type I** - Normal colon is absent and ileum opens directly into the colonic pouch.

**Type II** - The ileum opens into a short segment of caecum, which then opens into the pouch.

**Type III** - Presence of normal colon of significant length between the ileum and the colonic pouch.

**Type IV** - Presence of near normal colon with only the terminal portion of colon (sigmoid and rectum) converted into a pouch.

The present case is type II with entire colon beyond caecum opens into a blind pouch which is present in the umbilical cord. The exact embryogenesis of the pouch colon syndrome has not been worked out.

Impairment of intestinal organogenesis, primary dysplasia, congenital damage to myenteric plexus, intrauterine vascular catastrophe have all been considered as the reasons for abnormal dilatation of the bowel. Arrest of cloacal separation due to non-descent of urorectal septum along with faulty organogenesis of distal intestine close to descending urorectal fold would lead to Anorectal Malformation with abnormal dilatation of the bowel [7]. 90% of CPC are reported from the Indian subcontinent and predominantly from the Northern provinces. Earlier, type I CPC with high ARM was found to be common, but over years type IV CPC has been increasing [7].

The incidence of associated cardiac, vertebral and genitourinary anomalies is very high in CPC, so evaluation of other anomalies is important. The reported case was a male foetus with CPC in omphalocele associated with genitourinary anomalies (Potter's syndrome) and penoscrotal transposition, absence of left thumb and single umbilical artery.

Single umbilical artery is the most common developmental anomaly of the umbilical cord and is frequently associated with an increased incidence of atresia of the hollow visceral organs, gastrointestinal and urogenital abnormalities, musculoskeletal, cardiovascular and central nervous system malformations and limb reduction defects [8].

Complete Penoscrotal Transposition (CPST) is a rare and unusual malformation in which the scrotum is located cephalad to the penis, frequently associated with major and often life threatening malformations involving the urogenital, cardiovascular system, or skeletal systems. Parida et al. [9] have noted 90% complete agenesis of the urinary system. The most common non-urogenital abnormalities associated with CPST were mental retardation (60%), ano rectal malformations (33%), Central nervous system anomalies (29%), preaxial limb defects and congenital heart defects (19%).

It therefore appears likely that CPST may represent only one of the major localized or generalized embryological insult to the foetus during 4-6 weeks of development, when major organ system are passing through a crucial phase of development and differentiation [10]. The present case agrees with the above authors, that Potter sequence with Congenital pouch colon and ARM, CPST and absence of left thumb (i.e. preaxial limb defects) all due to generalized embryological insult during 4-6 weeks of gestation.

**Conclusion**

The index case is very rare with multiple congenital malformations. The foetus presented with Potter’s sequence, congenital pouch colon with ARM, absence of left thumb, Penoscrotal transposition and single
umbilical artery. These multiple malformations are not grouped in any of known classifications or syndrome.

The highlight of this study is these multiple malformations in a single foetus have not been reported in the literature so far. Anticipation of the frequency and multiplicity of this case is of paramount importance to the anatomists and particularly to the clinicians. Early antenatal sonographic diagnosis is important in view of dismal prognosis and allows for early, less traumatic termination of pregnancy.

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