Percutaneous Shunting For Fetal Lower Urinary Tract Obstruction: A Case-Series Study

Thesis
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بسم الله الرحمن الرحيم

" ثُمَّ جَعَلْنَاهُ نُطْفَةً فِي قَرَارٍ مَّكِينٍ• ثُمَّ خَلَقْنَا النُّطْفَةَ عَلَقَةً فَخَلَقْنَا الْعَلَقَةَ مُضْغَةً فَخَلَقْنَا الْمُضْغَةَ عِظَامًا فَكَسَوْنَا الْعِظَامَ لَحْمًا ثُمَّ أَنشَأْنَاهُ خَلْقًا آخَرَ فَتَبَارَكَ اللَّـــهُ أَحْسَنُ الْخَالِقِينَ "

صدق الله العظيم

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Noha Mohamed Halawa

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List of Abbreviations

AC	Abdominal Circumference
AUV/D	Anterior Urethral Valve/Diverticulum
BPD	Bi-Parietal Diameter
BEEC	Bladder Exstrophy Epispadias Complex
CAKUT	Congenital Anomalies of
CDK	Chronic Kidney Disease
CI	Confidence Interval
COPUM	Congenital Obstructing Posterior Urethral Membrane
CS	Caesarian Section
ERC	Ethics Research Committee
ESRD	End Stage Renal Disease
FL	Femur Length
GFR	Glomerular Filtration Rate
HC	Head Circumference
LUTO	Lower Urinary Tract Obstruction
MDS	Mullerian Duct System
Nd:YAG	Neodymium, y hrium-alminum garent
Ob/Gyn	Obstetrics and Gynecology
OR	Odd's Ratio
PBS	Prune Belly Syndrome
PLUTO	Percutaneous Shunting For Fetal Lower Urinary Tract Obstruction
PPROM	Prelabour Premature Rupture of Membranes
PUV	Posterior Urethral Valve
RR	Relative Risk
TLC	Total Leucocytic Count
U/S	Ultrasound
UG Sinus	Urogenital Sinus
UPJ	Uretero-Pelvic Junction
UTI	Urinary Tract Infection

List of Abbreviations (Cont.)

VACTERL	Vertebral, Anal, Cardiac, Tracheoesophageal, Renal and Limb Anomalies
VAS	Vesico-Amniotic Shunt
VCUG	Voiding Cysto-Urethrography
VUG	Voiding Urethrogram

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Abstract

Assessment of fetal and maternal outcomes in women who had interventions (vesicoamniotic shunting or serial ultrasound-guided vesicocentesis) to relieve their fetal lower urinary tract obstruction Vs those who underwent conservative management (follow up)

Lower urinary tract obstructions (LUTO) are caused by a narrowing at some point in the urinary tract that slows or stops the flow of urine. They are one of the most commonly identified abnormalities at the antenatal ultrasound scan with an estimated incidence of 1:250 to 1:1000 pregnant women. The majority of these abnormalities are because of obstruction, obstructive uropathy, which may occur at the uretero-pelvic junction or uretero-vesical junction or at the level of bladder neck. The most common identifiable causes of LUTO are urethral atresia and posterior urethral valves (PUVs). Other less common causes of lower urinary tract obstructions include urethral atresia (the second most common cause of lower urinary tract obstructions), anterior urethral valves, meatal stenosis, epispadias, and hypospadias.

The idea of the vesico-amniotic shunting or the PLUTO trial is the insertion of catheter with its proximal end in the amniotic fluid and its distal end in fetal urinary bladder to relieve the fetal urinary obstruction in an attempt to avoid renal parenchymal damage and chronic oligohydramnios that in turn adversely affect the pulmonary development. The indicator for immediate success of the procedure is the immediate de-compression of the distended fetal bladder. The mother is to be followed every two weeks till delivery, recording the fetal bladder dimensions, amniotic fluid volume and any observed fetal renal cystic or dysplastic changes till the baby is delivered and the obstruction is relieved surgically in post-natal life.

The most important question was the effectiveness of in-utero therapy and the correct timing, as its management constitutes an ongoing challenge in obstetric and pediatric practices. Although many suggested that prenatal intervention in cases of congenital bladder neck obstruction improves perinatal survival but when considering the effect on long-term survival with normal postnatal renal function, the results suggested that intervention have adverse sequalae (in terms of morbidity), although this finding was not statistically significant.

Keywords: PUV: Posterior Urethral Valve**;** Key-hole sign.

Thesis Protocol

Introduction of the protocol:

Congenital abnormalities of the urinary tract are one of the most commonly identified abnormalities at the antenatal ultrasound scan with an estimated incidence of 1:250 to 1:1000 pregnant females. This incidence depends on acquisition of pre and postnatal data and whether terminations of pregnancy, related to the condition, are included or not. The majority of these abnormalities are because of obstruction, obstructive uropathy, which may occur at the ureteropelvic junction or ureterovesical junction or at the level of bladder neck **(Diwakar et al., 2013).**

Lower urinary tract (urinary bladder outflow) obstruction (LUTO) is a relatively common congenital group of pathologies, the most common of which are urethral atresia and posterior urethral valves (PUVs). Other less common etiologies include: urethral agenesis, persistent cloaca with associated urethral stenosis. It is generally identified in the second trimester of pregnancy (18-24 weeks) when most of the pregnant females have a routine detailed fetal anomaly ultrasound scan **(Morris et al., 2009).**

PUVs account for one third of urinary tract anomalies detected at autopsy after termination of pregnancy. They also account for about half of the cases presenting with ultrasonographic features of LUTO. They represent membranous folds present in the posterior wall of the urethera and are classified into three types according to their location and the gross anatomical characteristics. Type I is the most frequent type and its effect depends on the severity and timing of initiation of obstruction in-utero. Other commonly associated congenital urinary tract anomalies with PUVs include: duplicated urethera, megalo-urethera, cryptorchidism and hypospadias. While other associated

congenital extraurinary anomalies include: cardiovascular system anomalies, scoliosis and chromosomal abnormalities **(Morris et al., 2006).**

The fetus with PUV is typically male unless associated with hypoperistalsis syndromes (e.g. Megacystis-Microcolon-Hypoperistalsis Syndrome) which carry a worse prognosis. They usually lead to -if untreated- megacystis, bladder wall hypertrophy, megaureter, hydronephrosis and renal dysplasia. The importance of LUTO in terms of perinatal outcome lies in its clinical course, where the long-term urethral obstruction is potentially associated with cystic renal dysplasia and abnormal renal function (glomerular and tubular) that in turn leads to severe oligohydramnios, pulmonary hypoplasia and positional limb abnormalities **(Morris et al., 2006).**

Fetal LUTO -if untreated- carries a mortality of up to 45% mainly due to severe oligohydramnios being associated with pulmonary hypoplasia at a crucial time of lung development (canalicular phase between 16-24weeks). Even in those who survive the neonatal period, about one third of cases may develop end-stage chronic renal impairment necessitating dialysis or renal transplantation in infancy or childhood **(Morris et al., 2006).**

Several prenatal techniques have been employed in attempts to improve the prognosis of the condition via alleviating the obstruction in utero. According to a Randomized Control Trial (RCT) published in Nov.2013, a comparative study was held between the effectiveness of conservative management and follow up of the fetus Vs the antenatal percutaneous vesico-amniotic shunting for fetal lower urinary tract obstruction (PLUTO). This RCT has proved that the PLUTO trial has an upper hand in the management of fetuses with lower urinary tract obstruction as regard their perinatal morbidity and mortality rates than that of conservative management **(Morris et al., 2013).**

The idea of the vesico-amniotic shunting or the PLUTO trial is the insertion of catheter with its proximal end in the amniotic fluid and its distal end in fetal urinary bladder to relieve the fetal urinary obstruction in an attempt to avoid renal parenchymal damage and chronic oligohydramnios that in turn adversely affect the pulmonary development **(Kilby et al., 2004).**

Other antenatal surgical attempts to relieve the fetal lower urinary tract obstruction are: ultrasound-directed serial vesicocentesis (regular insertion of a fine needle to drain the fetal bladder of urine) and fetal cystoscopy with posterior urethral valve fulguration **(Morris et al., 2010).**

Aim of the Work

Assessment of fetal and maternal outcomes in women who will have interventions (vesicoamniotic shunting/ serial vesicocentesis) to relieve their fetal lower urinary tract obstruction.

PROTOCOL OUTLINE:

Study Site:

Fetal-Therapy Unit, Ain-Shams University Hospitals.

Study Objectives:

Primary Objectives

- The main outcome measure will be the assessment of perinatal mortality rates for fetuses undergoing interventions (vesico-amniotic stunts or serial vesicocentesis) for lower urinary tract obstruction.

Secondary Objectives

1. Assessment of maternal complications from the procedure (e.g. infection, injury to uterus, preterm labor and premature rupture of membranes).
2. Assessment of renal function in survivors (serum creatinine).

Study Design:

An observational, case-series study.

Target Population:

Male Fetus with ultrasonographic evidence of lower urinary tract obstruction (enlarged bladder, keyhole sign of the urinary bladder, bilateral hydronephrosis).

Study Treatment and Methodology:

After ultrasonographic diagnosis of LUTO, appropriate counselling and consent, the insertion of the vesicoamniotic shunt or serial vesicocentesis can be performed. In general terms, the woman is given some sedation and prophylactic antibiotics 2 hours prior to the procedure. The woman is scanned, and the fetal bladder is visualised. Under sterile, minimal touch technique, the percutaneous placement of the vesicoamniotic pigtail Harrison Foetal Bladder Stent is performed under ultrasound guidance. Correct placement of the shunt and viability should be noted postprocedure. Follow-up scans will be arranged at the clinicians' discretion but usually are performed no less frequently than every 2 weeks. If not feasible, then plan for serial vesicocentesis will be arranged usually every fortnight.

Selection of patients:

Inclusion Criteria:

1- An informed consent is given.

2- Patients able to understand the information provided.

3- Pregnant female with single viable male foetus in first or second trimester.

4- Evidence of isolated lower urinary tract obstruction (LUTO) by ultrasound imaging in the first and second trimester.