

Original Research Article

GENITOURINARY AND ANORECTAL MALFORMATIONS IN PERINATAL AUTOPSY IN A TERTIARY CARE CENTRE, SOUTH INDIA

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ABSTRACT

Background: Congenital malformations remain a common cause of perinatal deaths. Although ultrasonography can give a fairly accurate diagnosis, perinatal autopsy is essential to confirm the diagnosis and identify the associated malformations. The aim of the study is to emphasize the importance of perinatal autopsy in diagnosing Genitourinary and anorectal malformations. **Materials and Methods:** Retrospective analysis of fetal and perinatal autopsies was done. All fetuses underwent internal and external examination and histopathological examination. Our study comprises of 300 perinatal autopsies out of which 60 cases of genitourinary and anorectal malformations were identified.

Results: A total of 60 cases with Genitourinary and anorectal malformations were identified. Most of them were renal malformations followed by urinary tract malformations. Multicystic renal dysplasia was the most frequent renal anomaly followed by renal agenesis and other renal anomalies. Cloacal malformations, urorectal septum malformation sequence, VACTERL association, OEIS Complex, and other syndromic and multisystem abnormalities were identified. Prenatal ultrasound findings and final autopsy findings were discrepant in subset of cases and autopsy identified additional abnormalities not detected antenatally.

Conclusion: Although prenatal ultrasonography reasonably predicts major malformations, fetal autopsy is essential for identifying additional malformations, resolving discrepancies and establishing a more complete final diagnosis.

Keywords: Genitourinary malformations, Fetal autopsy, anorectal malformations, urorectal septum, Malformation sequence

INTRODUCTION

A combined calculation of stillbirths and early neonatal deaths is known as Perinatal mortality. The most common cause of perinatal deaths in the developing countries like India is congenital malformations which accounts for 10-15%.^[1] The total number of stillbirths and deaths in the first week of life is known as Perinatal Mortality.^[2] The period between 28 completed weeks of conception to seven days after birth of neonate is known as perinatal period. Any deviation either in functional or structural from normal development including metabolic disorders. They are identified either

during prenatal period, at birth or in the later life.^[3] The abnormalities may results based on chromosomal defects, single gene mutations, exposure to teratogens, multifactorial inheritance or micronutrient deficiencies.

The word autopsy derived from the greek word which means "a seeing with one's own eyes".

Inspecting and dissecting of body after death is known as postmortem examination which is done to find out the cause of death. Perinatal autopsy is defined as an autopsy done on a neonate or fetus. Intrauterine foetal demise, termination of pregnancies for anomalies and inevitable abortion are the most common indications. Perinatal

mortality also tells us the quality of health care in the Community.^[4]

The most common congenital anomaly observed is the urogenital and anorectal malformations. The second common anomaly is central nervous system followed by cardiovascular system. The crucial role is played by imaging studies as they provide information regarding the disorders during the prenatal period. Similarly major portion of information like the etiopathogenesis, exact defect and associated syndromes etc is provided by the foetal autopsy. It can also identify the chromosomal aberrations and genetic syndrome. It also helps in guiding for further genetic testing and counselling.^[5] Further actions can be taken by the clinician for safe confinement of future pregnancies by knowing the cause of death. She or He can also explain the parents regarding how they can facilitate the progress of grieving and planning for future pregnancies.

As autopsy diagnosis sometimes changes the clinical diagnosis it gains more importance. Sonography misses soft tissue abnormalities which are picked during fetal autopsy thereby it provides secondary diagnosis. The aim of our study is to detect the cause of death which includes investigations comprising of foetal autopsy, placental examination and genetic studies including karyotyping.

Aims and Objectives: To emphasize the role of foetal autopsy in urogenital and anorectal malformations and to correlate the final autopsy findings with prenatal ultrasound features of these fetuses.

MATERIALS AND METHODS

All foetal and perinatal autopsies performed at the department of pathology, for a period of 5 years. Of the received 300 autopsies, 60 cases of foetal anorectal and urogenital malformations / abnormalities were identified and included in the study.

Inclusion criteria

- spontaneous abortion
- termination of pregnancy for foetal anomalies
- early neonatal deaths and still births.
- The fetuses of above 12 weeks of intrauterine life and within 7 days of postnatal life were taken into consideration.

Exclusion criteria: Fetuses with intrauterine death and other system abnormalities

Data collection method: The ethical committee approval of the institution was obtained for the study. After receiving the foetus for examination, an informed consent was obtained from either of the parents. Maternal data collection was done including age of the mother, obstetric history, gestational age, consanguinity status and history of any medications. Pregnancy outcome (termination of pregnancy/still born/live born/neonatal death) and mode of delivery

were documented. The autopsied fetuses had been examined prenatally with the ultrasound examination and the results were taken. The sonograms were carried out by both radiologists and also by obstetricians with ultrasound examination skills.

X ray examination (foetogram) was performed for all the fetuses. Photographs of the fetuses were taken before evisceration. Supine, prone with right and left lateral positions were taken. Closer pictures and insitu photographs were taken to document the abnormal features if any. Anthropometric measurements including body weight, head circumference, chest circumference, crown rump length, crown heel length and foot length were recorded. The external examination was performed systematically from head to toe including the general appearance and the skin. The internal examination was done using a linear incision starting from the chin to the neck, extending in the midline through thorax and abdomen^[6]. The incision is then curved around the left side of the umbilicus up to the symphysis pubis. In cases suspicious of urethral stenosis/ cloacal malformations or hydrops of unknown etiology, the incision was also extended on each sides of the external genitalia to include the anal opening.

Procedure: After the initial incision, the skin and the subcutis were dissected away till the exposure of the ribs. Then the chest plate was incised and the thoracic organs were exposed. Insitu examination of the thoracic and abdominal structures were done and documented. A curvilinear incision was made above the level of uvula and all organs of the neck, chest, abdomen including tongue was removed as one unit. Internal dissection of the organ block was done. After reflecting the aorta with the thoracic organs (above) and esophagus into abdominal organs (below), the thorax is separated from the abdomen at the level of diaphragm. Each organ systems were examined meticulously and organs were separated, weighed and the bits were given for microscopic examination.

Removal of the brain was done by making an incision in the scalp starting from behind one ear through the cranium and extend down behind the other ear. After reflecting the scalp anteriorly and posteriorly, two nicks were made in the lateral corner of the anterior fontanelle. After reflecting the falx cerebri, insitu examination of the brain was done and it is removed intact, weighed and fixed by hanging in formalin using gauze. After fixation, brain was sliced and relevant bits were given.

The placenta and cord were also examined, photographed and relevant sections were given. It includes two bits from the cord and membrane roll. The parenchyma is cut at 1 cm interval and a few full thickness parenchymal bits were given, including any macroscopic lesions. The sections were stained with hematoxylin and eosin and examined under microscope. After microscopic analysis, the results were correlated with clinical,

prenatal ultrasound findings and final results were drawn.

Statistical analysis: The collected data was entered in Microsoft Excel Sheet and transferred to SPSS software for analysis. Categorical data is expressed in numbers or percentages. Continuous data is expressed in mean and standard deviation. For all tests of statistical significance, p value of <0.05 was taken as significant.

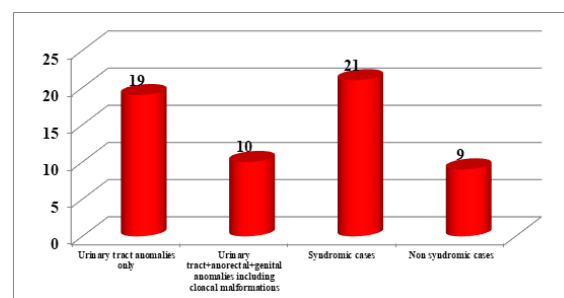
RESULTS

Among the 300 fetuses received during the study period, 60 fetuses with urogenital and anorectal anomalies were identified.

Table 1: Maternal factors found in malformed foetus and neonates:

Variable	Number (N)	Percentages(%)
Maternal age		
<20 years	1	2
21-30 years	56	93
>30 years	3	5
Parity		
Primigravida	39	65
Multigravida	21	35
Consanguinity		
Yes	9	15
No	51	85
Comorbidity		
Present	11	18
Absent	49	82
H/O spontaneous abortion		
Present	2	3
Absent	58	97

In our study majority of the study participants were in 21-30 years of age group 56 (93%). Primigravida was predominant 39 (65%). History consanguinity was present in 9 (15%) of the study participants. 11(18%) of the study participants have comorbidity. Spontaneous abortion was present in 2(3%). Urinary tract anomalies were found to 19 (47.5%) and Syndromic cases was present in 21(52.5%). Non syndromic causes /multisystem anomalies occurred in 9 cases and involving CVS, RS, GIT, CNS and skeletal systems.



Graph 1: Urinary and anorectal anomalies.

Table 2: Congenital anomalies of the kidney, the urinary system, including bladder, ureters and urethra:

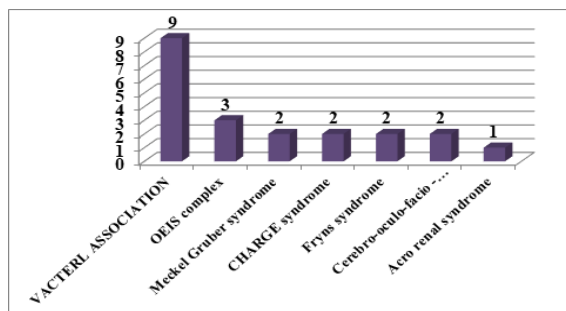
PRIMARY RENAL ANOMALIES	No of cases
Renal agenesis -Unilateral	6
-Bilateral	6
Renal ectopia	3
Crossed fused ectopia	3
Horse shoe kidney	2
Cystic renal diseases - ARPKD	3
ADPKD	3
Multicystic renal dysplasia	15
Hydronephrosis secondary to Bladder outlet obstruction	18
Bladder outlet obstruction	
Megacystis - PUV	4
-DUS	10
-Megalourethra	2
-Renal obstructive dysplasia	2
Absent bladder	3
Hypoplastic bladder	6
Extrophy of bladder	1
URETER	
Ureteric stenosis	3
URETHRA	
Megalourethra	2
Urethral duplication	1
Urethral atresia	8

Hydronephrosis secondary to bladder outlet obstruction is found more followed by Multicystic renal dysplasia.

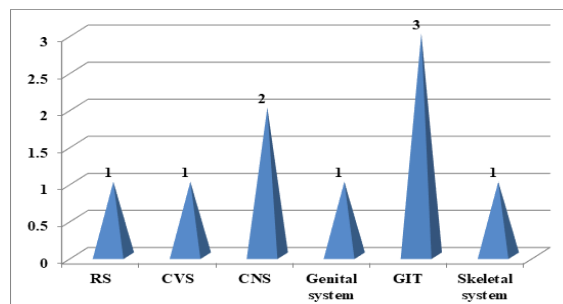
Table 3: spectrum of urorectal septal (cloacal) malformations

Cloacal malformations	Number of cases
Complete URSM	5
Partial URSM	5
Urogenital sinus	3
Persistent cloaca	3
Exstrophy of cloaca	1
Persistent Mullerian duct syndrome	1

The most cloacal malformation is Complete URSM and partial URSM

**Graph 2: Urogenital & Anorectal Malformations In Syndromic Associations:**

In syndromic association vacteral was found more among our study participants 9 followed by OEIS complex.

**Graph 3: Non Syndromic Multisystemic Congenital Anomalies Associated With Urogenital & Anorectal Malformations:**

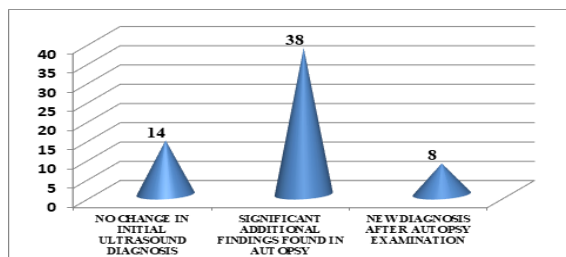
The most common system involved with association is GIT followed by CNS.

Table 4: Associated malformations in fetuses with imperforate anus

S. No	Imperforate anus with associated malformations	Number of cases (n=18)
1	Vacterl Association	6
2	Oeis Complex	3
3	Complete Ursm	3
4	Partial Ursm	3
5	Sirenomelia	2
6	Persistent Mullerian Duct Syndrome	1

Vacteral association was found to be associated with imperforate anus 6/18 followed by OEIS complex 3/18.

In 14/60 cases, the antenatal ultrasound findings were correlated with final autopsy diagnosis. Significant additional findings were frequently observed after final autopsy diagnosis (38/60 cases). Discrepancies between ultrasound and autopsy findings were seen in 8/60 cases. Some of the syndromic causes were diagnosed only after autopsy examination, which was missed in antenatal ultrasound. USG showed evidence of Joubert's syndrome in one of the foetus, but autopsy findings favoured Meckel gruber syndrome. Oligohydramnios secondary to bladder outlet obstruction was noted in many of the cases.

**Graph 4: Ultrasound And Autopsy Findings Correlation:****Figure 1: (Autosomal Dominant Polycystic Kidney Disease (ADPKD). 1a to 1d****Figure 1a: Gross Appearance - Both kidneys are enlarged with hypoplastic bladder.****1b – External shows multiple cysts replacing entire cortex and medulla ranging in size from 0.2 to 1.0cm**

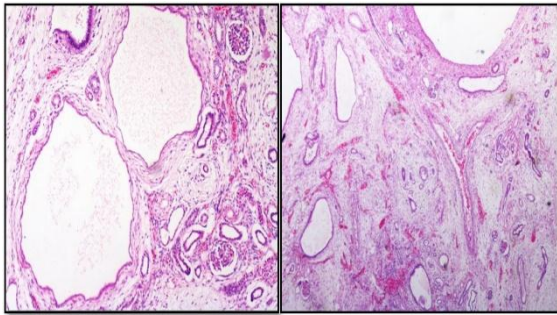


Figure 1c & 1d: HPE - Shows multiple cysts lined by cuboidal epithelium. Normal preserved glomeruli are seen between the cysts. Interstitium is loose, shows congested vessels.

Figure 2: Meckel Gruber Syndrome With The Following Features: 2a. to 2d - ARPKD:



Figure 2a: B/L kidneys are enlarged and shows persistent foetal lobulation.



Figure 2b: The cut surface shows diffuse multiple tiny cysts seen throughout the cortex and medulla and gives spongy appearance.

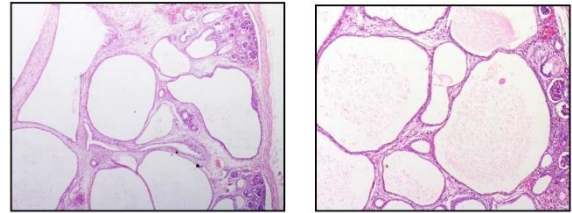


Figure 2c & 2d: HPE - Shows patchy sub-capsular nephrogenic zone with normal glomeruli. The remaining cortex and medulla show numerous cysts of varying sizes lined by flat to cuboidal epithelium.



Figure 3: Female pseudohermaphroditism - ambiguous genitalia with phallus like structure

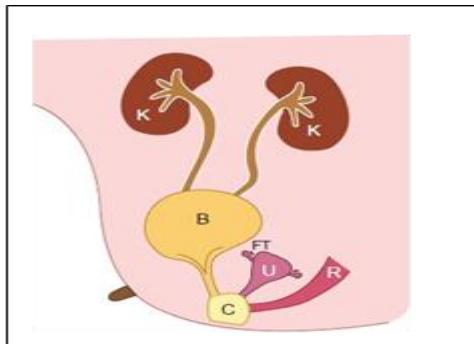


Figure 4: Posterior urethral valve -The bladder wall is thinned out. Folds of mucosa forming a membrane like structures, which is extending from verumontanum to bladder neck causing obstruction and cystic dilatation

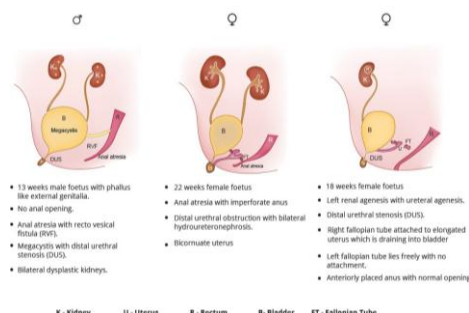


Figure 5: VACTERL ASSOCIATION. 5a & 5b. The left clubfoot with a single digit. The right foot is 'rocker bottom' in type

Figure 6: Complete URSM



6a and b. Megacystitis with hydronephrosis, dilated and tortuous ureters and a cloacal pouch



7. Incomplete Urorectal septal formation

DISCUSSION

The prevalence of genitourinary and anorectal malformations in our study is 20% (60 out of 300 cases). This is similar to studies done by Andola et al^[7] (20.45%) and Potekar et al^[8] (20%). But the prevalence was less than studies done by Naik et al^[9] (25%) and Shailaja A. Kupati^[10] (31.48%). The spectrum of Urogenital and anorectal malformations is extremely vast, but occur in significant frequency and varies from mild to severe. In this study, we have analysed 60 fetuses with urogenital and anorectal malformations and could provide an overview of the aetiopathogenesis of the underlying causes with associated malformations syndromic to severe anomalies, which are incompatible with life. The urogenital and anorectal malformations arise from a defective development of the cloaca which leads to incomplete division or fusion of the cloacal membrane with urorectal septum. A gamut of anomalies may develop depending upon the severity level of the defects.

Urinary tract anomalies were found to 19 (47.5%) and Syndromic cases was present in 21 (52.5%). Non

syndromic causes /multisystem anomalies occurred in 9 cases and involving CVS, RS, GIT, CNS and skeletal systems. The commonest renal fusion anomaly in literature is horse shoe kidney.^[11,12] In contrary, we encountered crossed fused renal ectopia (n=3) more commonly than horse shoe kidney (n=2). It was found incidentally in 21 week male foetus and had associated major anomalies such as aqueductal stenosis, hydrocephalus, VSD, hypoplasia of bladder, thumb and lungs.

ARPKD is the most frequently encountered ciliopathy seen in utero and in infants due to an abnormality in the development of renal collecting ducts. The foetus also had bile ductular proliferation and periportal fibrosis. Since the polycystic kidney hepatic disease 1 (PKHD1) gene encodes a protein which is situated in primary cilia of kidneys and biliary tract, renal cystic disease and intrahepatic biliary disease were identified simultaneously.^[13] Posterior urethral valve is one of the most common cause of lower urinary tract obstruction identified in our series. The cases of PUV had abdominal distention, megacystitis, tortuous and dilated ureters. The kidneys often show subcapsular peripheral cysts with dilated pelvis and multicystic dysplasia. Dewan and Goh were the first researchers proposed about congenital obstructive posterior urethral membrane and subsequently it was histologically confirmed by Baskin.^[14,15] One of the uncommon cause of bladder outlet obstruction was congenital megalourethra. It was classified into scaphoid and fusiform variants by Dorairajan in 1962^[16]. We also observed some of the cases with the above findings due to megacystitis.^[17] The term 'URSM' sequence was coined by Escobar et al in 1987 and he reported 6 cases with URSM only in females^[18]. In 1997, Wheeler et al noted URSM cases in male fetuses also with the Male: female ratio of 7:6. In 2006, Patil & Phadke reported ratio of males to female URSM cases as 0.87. In contrary, we encountered URSM in 4 female and 1 male fetuses. Hence female predominance was observed in our series. In 2001, Wheeler and Weaver reported a non lethal form of URSM and called it as partial URSM, which is characterized by single perineal/anal opening with an imperforate anus. Since partial URSM cases have a good prognosis in contrast to Complete URSM, it is mandatory to differentiate these 2 entities. In our study, We found 5 cases each of complete and partial URSM. Cases with hypospadias and large penis with epispadias were noted in male fetuses. Prominent clitoris was observed in female fetuses.

VACTERL Association was the commonest syndrome identified in our study. Uehling, Gilbert and Chesney described the urologic implications of VATER^[19]. The closest differential diagnosis of VACTERL included was URSM, since both the conditions can have vertebral abnormalities with limb defects, cardiac defects, imperforate anus, tracheo - esophageal fistula and renal anomalies.

According to Chien et al, anomalies of genitalia, urinary tract, anal atresia and sacral Hypoplasia were frequently found in URSM than VACTERL. Similarly, in our study we observed more chances of anomalies involving the genital (ambiguous), lower GI (colonic atresia) and urogenital tracts and sacral agenesis than VACTERL. The renal abnormalities were common in both the conditions.

High occurrence of vertebral (hemivertebrae), limb anomalies (talipes, radial aplasia, polydactyly, absent forearm and feet) cardiac defects (TOF, PDA, VSD, right aortic arch) and atresia /fistula of upper aerodigestive tracts (TEF, esophageal atresia, pyloric atresia, absent gallbladder & appendix) were encountered in cases with VACTERL. Interestingly, we found VACTERL Association with coexistent URSM in two of our cases (each with partial and complete URSM).

OEIS complex represents an extended phenotype for exstrophy of cloaca. In 1978, Carney et al coined the term 'OEIS complex' as an acronym and is characterised by abnormalities involving the lower region of the body. This includes omphalocele, exstrophy of bladder, imperforate anus and spinal defects. Apart from the findings in acronym, we also found hydrocephalus, bilateral renal agenesis, absent external genitalia and persistent mullerian duct remnants (in a male foetus) in our OEIS fetuses. In our study, we found Meckel Gruber syndrome in our

study, which is characterized by the presence of multicystic kidney dysplasia, CNS malformations, orofacial clefts, polydactyly and congenital hepatic fibrosis.

Urogenital and anorectal malformations were frequently associated with anomalies of other systems, among which Gastrointestinal (33%) and Central nervous system (22%). Followed by Skeletal system defects 1(11%) and Cardiovascular 1(11 %) Most of the fetuses had pulmonary hypoplasia secondary to oligohydramnios.

The combination of urinary tract with anorectal and genital anomalies was generally acceptable, since lower GIT and urinary tract have a common origin(cloaca) during development.

We correlated prenatal ultrasound findings and final autopsy results of our fetuses with urogenital and anorectal malformations. Complete agreement between prenatal ultrasound findings and autopsy findings was found in only 14 cases (23.3%). These cases were persistent urogenital sinus, bilateral multicystic dysplastic kidneys, VACTERL association, OEIS complex, bilateral renal agenesis and CAKUT. This is in contrast to a study done by Antonella et al in 2012, where there was a 49% of complete agreement. In 63.3% of cases autopsy added additional findings with revision of diagnosis and this caused significant change in recurrence risk.

Comparison Of Autopsy And Ultrasound Findings In Various Studies:

Studies	Total Number Of Cases	No Change In Initial Ultrasound Diagnosis	Significant Additional Findings Found In Autopsy	Change In Initial Ultrasound Diagnosis (Discrepancy)
Our study	60	23.3%	63.3%	13.4%
Sankar and Phadke, ^[20]	134	41%	58%	1.49%
Vimercati et al, ^[21]	144	71	35	17
Venkatasamy C, ^[22]	45	37.7	22.2	33.3

When compared to the results of other study ours showed more of additional findings especially of urorectal septum malformation sequence. Anomalies of all systems were correlated in their study, in contrast we compared only of urogenital and anorectal malformations.

Complete discrepancy was noted in 13.4% of cases. Anomalies that were picked up by autopsy examination were distal urethral stenosis, choanal atresia, tracheo esophageal fistula, hand and facial abnormalities and urorectal septum malformation sequence.

Accurate diagnosis for the cause of non immune hydrops foetal is cases, especially secondary to bladder outlet obstruction was possible by thorough autopsy examination.

Reasons for discordance in ultrasound findings can be due to foetal position, operator experience, amniotic fluid volume and maternal obesity leading to poor visualization of foetal anatomy. The highest rate of discordance was found in multiple anomalies

Limitations And Recommendations: The main limitation is Retrospective nature of our

study. Second limitation is most of our cases were not correlated with chromosomal test results, hence an associated chromosomal aberrations cannot be totally excluded. Thirdly we have not classified anorectal malformations in to high, intermediate and low types. Still birth with superimposed autolytic changes cases distorted anatomy of few cases. A large prospective study including chromosomal analysis in future will contribute in enhance our understanding of the disease process and also will help in parent counselling. The foetal autopsy will contribute to establish the cause of death, to understand the disease process and to confirm the prenatal diagnosis. It will also help us to find out the effectiveness of treatment (artificial reproductive techniques) and to identify the new or re-emerging disease. Families can be made aware of the possible cause of death and its hereditary implications. Autopsy results can also contribute to medico legal aspects, research, audit and be helpful as quality check for prenatal ultrasound examination. Modern imaging techniques, advancements in prenatal diagnosis, genetic analysis and in utero targeted

therapeutic options are being considered to support, but not to replace the vital aspect of autopsy. It cannot be overemphasized that the effect of any form of therapy is primarily dependent on meticulous autopsy examination and its clinico pathological correlation.

CONCLUSION

Our study concluded that the associated renal abnormalities was found in almost all the foetuses of our series, and include uni /bilateral renal agenesis, multicystic renal dysplasia and polycystic kidney disease. Distal urethral stenosis was most commonly observed as a cause of megacystis in our study and was followed by posterior urethral valve. Uro rectal septum malformations /cloacal dysgenesis sequence, a lethal form of urogenital and anorectal anomalies, represented frequently. Syndromic associations was also found in our Urogenital and anorectal foetuses. The most common syndrome identified was VACTERL association followed by OEIS complex and Meckel Gruber Syndrome.

The associated non syndromic other system abnormalities were also encountered in our study, comprised of gastrointestinal tract, central nervous system and cardiovascular systems in a descending order. The cause of urogenital and anorectal malformations appears to be heterogenous with diverse aetiology. The prognosis and survival of the foetus is usually determined by the underlying cause. The finding of oligo/ anhydramnios should trigger a thorough examination of urogenital and anorectal system. It should also direct us to look for an associated other systemic malformations for grouping them into syndromic/ non syndromic multisystem involvement/ chromosomal aberrations. A meticulous post mortem examination of the foetus with cause analysis play a vital role to arrive at a final diagnosis and help us to understand the aetio pathogenesis. Foetal autopsy not only confirms the prenatal ultrasound findings, but also adds additional findings or changes the final diagnosis. Since some of the congenital anomalies have genetic preponderance, the establishment of correct diagnosis will help us to assess the recurrence risk and to counsel the parents regarding next pregnancy outcomes. It will also guide the clinicians and parents for early intervention or in utero targeted therapy.

Recent advancement in imaging studies, genetic and molecular techniques can complement but cannot replace a complete and thorough autopsy examination. Hence our present study emphasize the crucial role of foetal autopsy in all cases of suspected urogenital and anorectal malformation.

REFERENCES

1. Sankar VH and Phadke SR. Clinical utility of fetal autopsy and comparison with prenatal ultrasound findings. *Journal of Perinatology*. 2006;224-29
2. World Health Organization Neonatal and Perinatal Mortality: Country, Regional and Global estimates. World Health Organization ;Geneva, Switzerland; 2006
3. Ernst LM. A pathologists perspective on the perinatal autopsy. *Semin Perinatol*. 2015;39(1):55-63.
4. Fatima U, Sherwani R, Khan T, Zaheer S. Foetal autopsy- categories and causes of death. *J Clin Diagn Res*. 2014;8(10):FC05-FC8.
5. Sankar VH, Phadke SR. Clinical utility of fetal autopsy and comparison with prenatal ultrasound findings. *J Perinatol*. 2006;26:224-9.
6. Venkataswamy C, Gurusamy U, Lakshmi SV. Second-trimester fetal autopsy: A morphological study with prenatal USG correlations and clinical implications. *J Lab Physicians*. 2018;10(3):338-345.
7. A S Uma, AM Anita, Ahuja M, Andola SK. Congenital malformations in perinatal autopsies-A study of 100 cases. *JCDR*. 2012;6(10):1726-1730
8. RM Potekar, Javali P Anita and BR Yelikar. Autopsy study to determine fetal anomaly: a retrospective cohort study. *Int J Pharm Bio Sci*. 2014;5(3): (B)64-69
9. Siva sankara Naik V. Study of various congenital anomalies in fetal and neonatal autopsy. *Int J Res Med Sci*. 2015;3(5):1114-1121
10. Shailaja A Kupati, Anita A .M, Anuradha G. Patil, Sainath K, Andola. Study of Genitourinary malformations in perinatal autopsies.
11. Bauer SB. Anomalies of the upper urinary tract. In *Campbell's Urology*, vol. 3 (8th edn), Walsh PC, Retik AB, Vaughan ED Jr, Wein AJ (eds), WB Saunders: Philadelphia, 2002; 1885-1924.
12. J. Y. Cho, Y.-H. Lee, A. TOI and B. MACDONALD. Prenatal diagnosis of horseshoe kidney by measurement of the renal pelvic angle. *Ultrasound Obstet Gynecol* 2005; 25: 554-558
13. Patil SB, Paricharak MD, Paricharak DG, More SS. Fetal polycystic kidney disease. Pathological overview. *J Sci Soc* 2013; 40:106-8.
14. Dewan PA, Goh DG. Variable expression of the congenital obstructive posterior urethral membrane. *Urology*. 1995 Mar. 45 (3):507-9.
15. Young HH, Frontz WA, Baldwin JC. Congenital obstruction of the posterior urethra. *J Urol*, 3: 289-365, 1919. *J Urol*. 2002 Jan. 167 (1):265-7; discussion 268
16. Jones EA, Freedman AL, Ehrlich RM. Megalourethra and urethral diverticula. *Urol Clin N Am* 2002; 29: 341-8
17. Rodriguez MM. Congenital anomalies of the kidney and the urinary tract (CAKUT). *Fetal Pediatr Pathol*. 2014;33:293-320.
18. S.J.P.S. Patil. Urorectal septum malformation sequence: Ultrasound correlation with foetal examination. *Indian J Paediatr*, 73 (4) (2006), pp. 287-293.
19. Solomon BD., VACTERL/VATER Association. *Orphanet J Rare Dis* 2011; 6: 56
20. Sankar VH, Phadke SR. Clinical utility of fetal autopsy and comparison with prenatal ultrasound findings. *J Perinatol*. 2006;26:224-9.
21. Vimercati A, Grasso S, Abruzzese M, Chincoli A, de Gennaro A, Miccolis A, et al. Correlation between ultrasound diagnosis and autopsy findings of fetal malformations. *J Prenatal Med*. 2012 Apr;6(2):13.
22. Venkataswamy C, Gurusamy U, Lakshmi SV. Second-trimester fetal autopsy: A morphological study with prenatal USG correlations and clinical implications. *J Lab Physicians*. 2018;10(3):338-345.