

# ETIOLOGY OF END STAGE RENAL DISEASE (ESRD) IN SHIRAZ PEDIATRIC HEMODIALYSIS CENTER

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## ABSTRACT

One-hundred and sixteen children with ESRD were registered in Shiraz Pediatric Hemodialysis Center in Nemazee Hospital, a referral center in the south of Iran, from 1990 to 1999. Very small children are not dialysed in this center due to technical problems. The age range of children in this center was 2-16 years, mean age was  $10.4 \pm 3.6$  years and male to female ratio was 1.4. Major causes of ESRD in order of frequency were glomerulopathies 23 (19.83%), reflux 15 (12.93%), chronic pyelonephritis without reflux 11 (9.5%), neurogenic bladder 10 (8.62%), cystic diseases 10 (8.62%), stone disease 9 (7.75%), posterior urethral valve 7 (6.03%), ureteropelvic junction obstruction 7 (6.03%), and unknown 12 (10.35%). Despite the low number for statistical analysis, reflux, neurogenic bladder, FSGS, nephronophthisis and stone disease were found to be more common here compared with other centers, which means more consideration is required. Thirty-nine of these children (33.6%) have been transplanted, mostly from parents. *MJIRI, Vol. 15, No. 1, 23-26, 2001.*

**Key words:** End-stage renal failure, Pediatrics, Etiology, Epidemiology, Iran.

## INTRODUCTION

Nemazee Hospital Pediatric Hemodialysis Center in Shiraz is a referral center in the South of Iran, offering special care to children with ESRD.

ESRD occurs in all age groups. The incidence of ESRD is not yet clearly known, because it is evaluated on the basis of the number of patients accepted for dialysis and transplantation programs and is thus underestimated. In the U.S. renal data system,<sup>1</sup> it is estimated to be 11/million population per year in children 0-19 years old. The etiology of ESRD varies among different age groups of children, and congenital structural anomalies, including reflux, obstruction, hypoplasia and dysplasia are common causes particularly in younger children. Glomerulopathies outweigh other causes in older children.<sup>2,3</sup> There are no published reports regarding this issue in this area of the world in children. In a general report from this region, Sadeghi states that one percent of inpatient pediatric disease belongs to chronic renal failure.<sup>4</sup> In this study, the etiologies of ESRD as well as the rates of transplantation are compared with the results

of other studies.

## PATIENTS AND METHODS

The medical records of all children between 2-16 years old who were registered in Shiraz Pediatric Hemodialysis Center from December 1990 till March 1999 were reviewed.

All the points in medical records including history, physical examination, laboratory investigations and imaging studies were considered for an appropriate diagnosis. Kidney biopsy reports with light microscopic and immunofluorescent studies were the basis for diagnosis in glomerular diseases and hemolytic uremic syndrome, together with clinical findings.

All cases of nephronophthisis also had favorable pathologic reports. In the single case of Alport syndrome with suggestive kidney biopsy findings, she had two other older sisters involved with the same problem. Diagnosis in all cases of neurogenic bladder was made by urodynamic studies and voiding cystourethrogram (VCUG) reports. The cases of reflux nephropathy were diagnosed on the basis of

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VCUG reports and the cases of chronic pyelonephritis without reflux either had a favorable history and pathologic reports or a  $^{99m}\text{Tc}$ -dimercaptosuccinic acid ( $^{99m}\text{Tc}$ -DMSA) scan. Meanwhile, all included cases had remained on dialysis for more than 3 months, and were either dialysis dependent or prepared for renal transplantation.

Cases of acute dialysis due to acute renal failure and poisoning were excluded.

### RESULTS

One-hundred and sixteen children with ESRD were registered in this center. These consisted of 68 boys and 48 girls, with an age range at presentation of 2-16 years. The mean age was  $10.40 \pm 3.6$  years,  $10.62 \pm 3.6$  years for boys and  $10.07 \pm 3.5$  years for girls.

The age and sex distribution of children with ESRD are summarized in Figure 1. The etiology of ESRD in the study group, the distribution of glomerular disease and (reflux-obstruction-infection) are summarized in Tables I, II, and III, respectively.

In the cystic disease group, there were 7 cases of nephronophthisis and 3 cases of polycystic kidneys. There were 9 cases of renal stone in this group. The youngest patient was a 4 year old boy with nephrolithiasis and nephro-

**Table I.** Etiology of ESRD in 116 children in Shiraz Pediatric Hemodialysis Center.

Etiology	Number	(Percent)
Glomerulopathies	23	(19.83)
Reflux, obstruction, infection, stone disease	60	(51.72)
Cystic diseases	10	(8.62)
Other hereditary nephropathies	5	(4.31)
Vascular disorders	5	(4.31)
Dysplasia-Hypoplasia	1	(0.86)
Unknown	12	(10.35)
Total	116	(100)

**Table II.** Types of glomerular disease in the study group.

Glomerular Disease	Number	(Percent*)
Focal segmental sclerosis	12	(10.35)
Membranoproliferative glomerulonephritis	5	(4.31)
Rapidly progressive glomerulonephritis	4	(3.45)
Infantile nephrotic syndrome	1	(0.86)
Lupus nephritis	1	(0.86)
Total	23	(19.83)

\*Percent of total

**Table III.** Distribution of patients in (reflux-obstruction-infection and stone disease) group.

Etiology	Number	(Percent*)
Reflux nephropathy**	15	(12.93)
Neurogenic bladder	10	(8.62)
Posterior urethral valve	7	(6.03)
Ureteropelvic junction obstruction	7	(6.03)
Chronic pyelonephritis without reflux	11	(9.50)
Stone disease	9	(7.75)
Extrophy of bladder	1	(0.86)
Total	60	(51.72)

\*Percent of total

\*\*Primary reflux

calcinosis. His 8 year old brother also had stone disease, most probably due to oxalosis. The other 7 patients with an age range of 6-15 years developed ESRD due to obstruction in the single kidney or bilateral obstruction.

Four cases of cystinosis and one case of Alport syndrome were included among the hereditary nephropathies.

In the group with vascular anomalies there were two cases of hemolytic uremic syndrome (HUS), one classical and the other an atypical case of HUS, and three cases of hypertension without any obvious cause.

There were 3 cases who had acute glomerulonephritis at presentation, but their workups had revealed an acute on chronic disease. One of them, an eight year old boy with clinical and paraclinical workups in favor of poststreptococcal glomerulonephritis (PSAGN) and grade 4 bilateral reflux had developed ESRD, 4 years after his PSAGN.

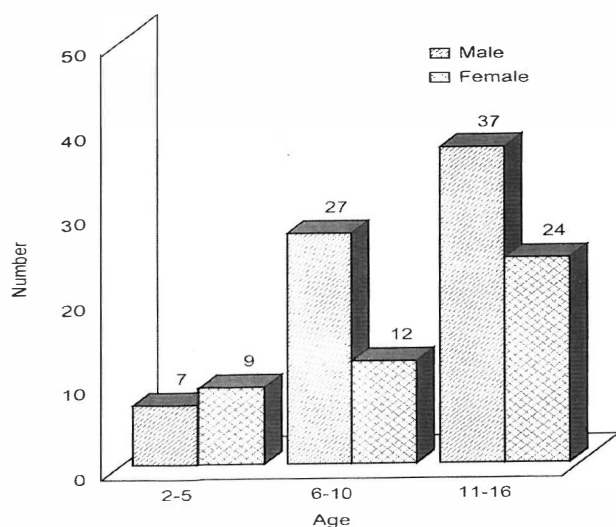
Two other cases with clinical and biopsy proven features of rapidly progressive glomerulonephritis (RPGN) developed ESRD at the same time and both of them had high grade reflux as well. The first of these 3 cases was included in the reflux-obstruction group and the other two in the glomerulopathy group.

Twelve patients who presented with ESRD and in an emergency need for dialysis couldn't be categorized in any of the above mentioned groups.

Thirty-nine of these children (33.6%) were transplanted during the study period, 20 of them received kidneys from their parents, 7 from cadavers and 12 from living non-related donors.

### DISCUSSION

During a major part of this study period (from the beginning up to 3 years ago), this center was the only center with a pediatric nephrologist in the South of Iran to offer specific treatment to children with ESRD. In the past 3 years, two other pediatric nephrologists have begun



**Fig. 1.** Age and sex distribution of children with ESRD in Shiraz Pediatric Hemodialysis Center.

taking care of children with ESRD in two other centers.

So our data includes in part all of the children with ESRD in this region of the country who have registered in this center for hemodialysis.

Patients with ESRD excluded from this group are:

1- Cases of newborn and very young children less than 2 years old (<10 kg) for whom we still have technical difficulties for dialysis.

2- Cases of ESRD who had to travel from very long distances.

3- The very few cases of ESRD who have been referred to the new centers in the past 2-3 years.

4- Cases of chronic renal failure who are still on conservative therapies (predialysis).

Considering the fact that this center is a referral center and due to the above mentioned factors, the actual incidence and prevalence of ESRD could not be determined.

The etiology of chronic renal failure in a report from Saudi Arabia<sup>6</sup> was as follows: posterior urethral valve (17%), reflux nephropathy (10%), neuropathic bladder (6%), polycystic kidneys (6%), nephronophthisis (6%), oxalosis (5%), cystinosis (1%), Alport syndrome (1%), renal dysplasia-hypoplasia (17%), glomerulopathies (14%), FSGS (2%), infantile nephrotic syndrome (5%), HUS (2%), crescentic GN (2%), mesangioproliferative GN (1%), chronic idiopathic GN (2%), and idiopathic (12%). In another report from Saudi Arabia, there are apparently similar results.<sup>7</sup>

In a report from Latin America (Brazil),

glomerulopathies (36%), urinary tract anomalies (32%), familial nephropathies (7%), multisystem disease (4%), and miscellaneous (7%) and unknown (18%) causes were the major causes of ESRD.<sup>8</sup>

In another study from Turkey, reflux nephropathy associated with neural tube defects and amyloidosis were more common than that in other studies.<sup>5</sup> In two reports from Sweden,<sup>9,10</sup> primary renal disease with preterminal and terminal renal failure were reviewed. There were approximately similar numbers of posterior urethral valves, nephronophthisis and crescentic glomerulonephritis as in our study but there were larger numbers of stone disease, reflux, FSGS, neurogenic bladder and membranoproliferative glomerulonephritis in the current study. Greater numbers of renal hypoplasia-dysplasia and congenital nephrotic syndrome in Swedish studies<sup>10</sup> are mainly methodological differences, since they have included all children with ESRD, but in our study; lower ages were not included because of technical problems for their hemodialysis, as mentioned before.

In three larger studies from USA,<sup>1</sup> Canada<sup>11</sup> and Germany<sup>12</sup> glomerulopathies were the cause of ESRD in 37.7%, 26.1% and 29.1% of cases respectively, slightly higher than the 20% in our study. Similarly, cystic diseases were the cause in 42%, 6.2%, and 13% respectively but was 9% in our study.

The number of cases of cystinosis are approximately similar.

Kidney transplantation was done in 39 (33.6%) of our patients (17 girls and 22 boys). The rate of transplantation in another study (1987-1989, in children under 19 years old) was 35.8%.<sup>1</sup> As in other studies most of the transplantations have been done from living related donors.

Despite the small number of children in this study and exclusion of very young ESRD cases, the prevalence of chronic pyelonephritis, stone disease, reflux and obstruction requires specific considerations for early detection and preventive measures in this region.

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## Hernia Repair by Modified Darn Method

part of the internal oblique and transversus abdominis muscle. From the second stitch, we turn the thread 360°, anticlockwise around its axis and pass the needle through it (Fig. 2,3). The stitches are held slightly tight—just enough to straighten the thread—but there must be no tension on it. No attempt is made to bring the transversus abdominis or the internal oblique muscle down to the inguinal ligament. The sutures are continued laterally up to the internal ring (Fig. 4). At this site, the stitch is locked and continued back toward the medial end—the pubic tubercle—with the same process as the first layer, but the axis of the stitches should make a 45° angle with the axis of the sutures in the first layer.

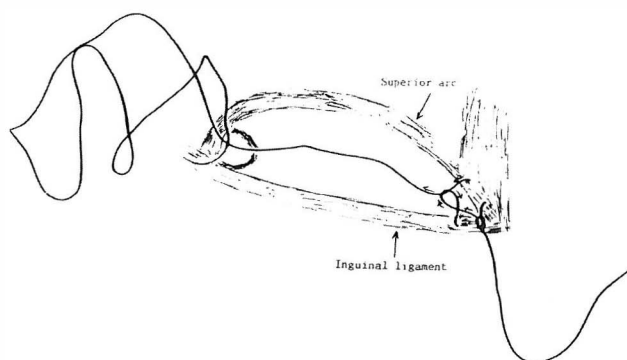


Fig. 1. Repair is begun at the medial end, using 1-0 nylon.

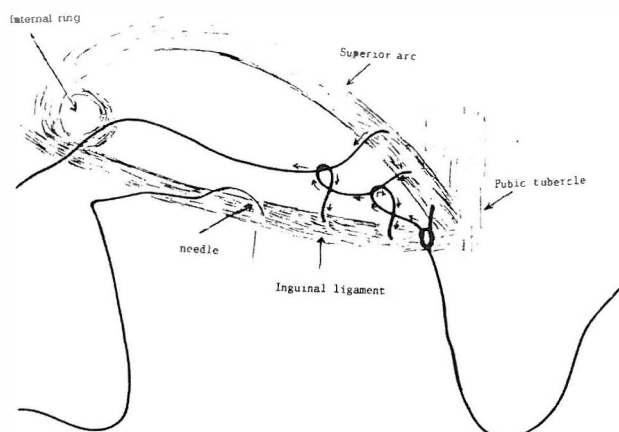


Fig. 2. From the 2nd stitch, the thread is turned 360° anticlockwise around its axis, and the needle is passed through it.

The stitches on the inguinal ligament and the top muscular layer are staggered to spread the tension between the fibers. At the pubic tubercle, the stitch is tied with the beginning of the thread (Fig. 5).

In this way, two inter-woven layers are formed in the floor of the canal and the amount of tension on each stitch

is specified by the surgeon. Stitches should not be loose or tight and the thread should not move in the surrounding tissue. In 2% of patients, we had to use two nylon threads.

In a prospective study during an 8 year period (from June 1991-June 1999), all patients with primary inguinal hernia who were referred to the author in teaching hospitals affiliated to Shiraz Medical University were treated by the above mentioned method. After evaluating the patients, they were operated on as outpatients, or were admitted to the hospital, and operated under spinal or general anesthesia.

All patients underwent this method of repair with no selective criteria, such as sex, age, general condition, duration of disease or size of the hernia.

## RESULTS

Patients who were treated by this method were 1452 in number with 1480 inguinal hernias (28 patients had bilateral hernias); 1425 were male and 27 female with an age range of 23 to 81 years. The average time of the operations was 35 minutes. The follow-up of the patients was done from 1 to 8 years (mean= 4.5 years). In the first year after operation, 92% of patients (1336 patients) had regular follow-up and after that, patients were requested to come back to the clinic if they had any problem. In the follow-up duration, only 3 patients (0.22%) referred with hernial recurrence, and were treated by mesh graft methods. Seventeen patients (1.1%) referred with wound infection in the 1st week postoperation or with stitch abscess which happened later, and were treated as outpatients and no recurrence occurred in this group.

Analgesics, such as acetaminophen or mefenamic acid were given to all patients for the first 3 postoperative days. But 6% of the patients needed analgesic medications for more than one week and they used it for 10 days in average.

There was no complication such as neuropraxia or hypesthesia related to ilioinguinal or genitofemoral nerves. 97% of patients were back to their usual job 5-7

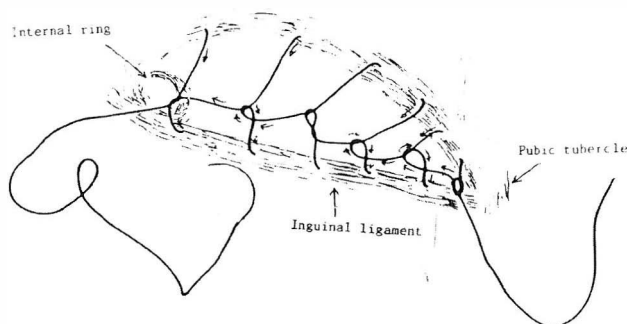
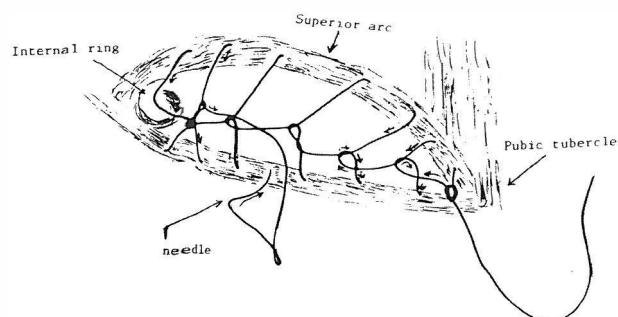


Fig. 3. The stitches are continued laterally up to the internal ring.



**Fig. 4.** At the internal ring, the stitch is locked and continued back toward the medial end, i.e. the pubic tubercle.

days postoperation.

### DISCUSSION

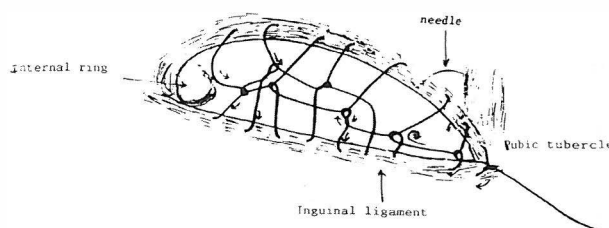
A good hernia repair should last for the rest of the life of the patient, no matter what his age at the time of the operation.<sup>19</sup> Although many types of repairs have been suggested,<sup>13</sup> the problem of recurrence has remained as before and is reported to range from 3 to even 30% in different studies.<sup>19</sup> Among factors related to the development of recurrence, tension on the repair and ignorance of anatomical function are more important.<sup>10</sup> Those repairs with tension also cause postoperative pain, and patients are not able to do their jobs for 2-3 weeks, and chronic pain is reported in 5% of these patients.<sup>24</sup>

In the darn repair, tension is minimized.<sup>19</sup> Abrahamson introduced his modification of the darn repair in 1987 using nylon no. 0 in 3 layers and reported his recurrence rate to be 0.8%.<sup>20</sup> But this simplified method has some problems:

1. Using 3 loop nylon threads which increases the cost of the operation.
2. Doing repair in 3 layers with loop threads, the handling of which is not so easy, prolongs the time of the operation.
3. No precise control of the surgeon on the tension of each stitch.
4. 3 big ties at the internal ring may cause some problems related to the ties.

In recent years, synthetic mesh has been used for reinforcement in treating inguinal hernias,<sup>10,11,22,23</sup> and the recurrence rate is about 2%.<sup>19</sup> Using a mesh graft has special problems, such as:

1. The use of it increases operation cost, especially in countries which have to import these materials.
2. Because of foreign body in the wound, the rate of wound infections is increased.
3. For the prevention of wound infections, antibiotics should be used.<sup>21</sup>



**Fig. 5.** The axis of the 2nd layer makes a 45° angle with the axis of the first layer of sutures.

The author modified the darn method and used it in 1480 hernia repairs as described. Using this method decreased the recurrence rate to 0.22%, wound infection to 1%, and the operation cost and time significantly because:

1. We use fewer threads, but by weaving the thread the same amount of strength seems to develop.
2. The surgeon can control the tension on each stitch and the thread will not move in the tissue or cut through it.
3. Repair is performed with fewer stitches, therefore ischemia of surrounding tissues is less.
4. Fewer threads are used with fewer stitches, the operation time and cost is decreased and is much cheaper than using synthetic mesh.
5. The rate of wound infection is low, because no foreign body such as mesh remains in the wound.
6. There is not much change in the anatomical function of the surrounding tissue.

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