

MINIMALLY INVASIVE SURGERY FOR CONGENITAL HYDRONEPHROSIS IN CHILDREN

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ABSTRACT

Introduction. Minimal invasive treatment for congenital hydronephrosis in children remains a controversial topic, both in defining the necessity and timing of operation using laparoscopic techniques in neonates and infants.

Materials and methods. This study aims to analyze criteria used for surgery in a series of patients operated in a laparoscopic manner, for congenital hydronephrosis, at the Emergency Clinical Hospital for Children "Marie Curie" Bucharest, Department of Pediatric Surgery, between 2007-2015.

Results. In our series, the most frequent found criteria for surgery were anterior-posterior diameter over 3 cm, followed by 50% reduced parenchymal thickness, decreased renal function under 40% and finally symptomatic criteria – urinary tract infections and flank colicky pain. Both pelvic dilatation and parenchymal thickness correlates with renal function, though reduced parenchymal thickness has a stronger correlation. Infants under 1 year and under 10 kg represented a significant proportion (17.5% and 22.5% respectively).

Conclusions. Young age (under 1 year old) and low-weight (under 10 kilos) in children are not reasons to delay classical or laparoscopic surgical treatment for PUJO (pyelo-ureteric junction obstruction). Pyelectasis is not specific to PUJO. It does not always mean obstruction and does not always show a strong correlation with impaired renal function. Best in establishing therapeutic conduct are the magnitude of renal parenchymal restructuring, the degree of renal function impairment and clinical symptomatology. Laparoscopic treatment is an effective surgical approach, that meets all the major advantages of minimal invasive surgery, applicable to infants and small children, regardless of age and weight.

Keywords: PUJO, congenital hydronephrosis, laparoscopic pyeloplasty

INTRODUCTION

The indications for surgical treatment in congenital hydronephrosis in children – pyeloureteral junction obstruction (PUJO) –, despite numerous debates, remains a controversial topic, both in terms of timing of surgery and in terms of the criteria used in determining the necessity of surgery. Although considered the treatment of choice in older children and adults, laparoscopic treatment of PUJO is still undergoing acceptance as a minimally invasive surgery in infants and toddlers.

This paper analyzes surgical criteria and distribution of age and weight in a group of pediatric patients operated minimally invasive.

MATERIALS AND METHODS

This article represents a retrospective study of a series of 34 consecutive patients operated laparo-

scopically for congenital hydronephrosis (PUJO), in the Pediatric Surgery Department of the Emergency Hospital for Children "Marie Curie" Bucharest, between 2007-2015.

The data collected from medical records and Hospital Manager software were:

- Age and weight;
- Colicky lumbar pain without the presence of urinary tract infections;
- Previous episodes of urinary infections;
- Anterior-posterior diameter of the pelvis;
- Renal parenchyma dimensions both in absolute and in relative value (compared to the normal value for the patient's age);
- The index pelvis/cortex;
- Split renal function determined by DTPA scintigraphy.

We considered the following five criteria for laparoscopic surgical indication, and we analyzed

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their frequency and distribution in the studied group:

Simptomatology	C1	Colicky lumbar pain without the presence of urinary infection
	C2	The presence of urinary infection episodes in history
Alterations in renal morphology	C3	Anterior-posterior diameter of the pelvis with values > 3 cm
	C4	Renal parenchyma thickness below 50% of normal
Alterations in renal function	C5	Renal relative function under 40%; progressive deterioration of renal function

The results were analyzed as frequency and distribution of surgical criteria and characteristics of patients in the study group.

RESULTS

The study group is composed of 34 patients with unilateral hydronephrosis and 3 patients with bilateral hydronephrosis. Patients' age at the time of surgery was between 3 months and 18 years, with an average of 6.7 years; their weight was between 6 and 90 kg, with an average of 27.9 kg. The distribution by age and weight is shown in Tables 1 and 2.

TABLE 1. Numerical and percentage distribution by age

Age (years)	Number of patients (n)	Percentage distribution (%)
0-1	7	17,5
1-5	12	30
5-10	9	22,5
10-18	12	30

TABLE 2. Numerical and percentage distribution by weight range

Weight range (kg)	Number of patients (n)	Percentage distribution (%)
0-10 kg	9	22.5
10-20 kg	12	30
>20 kg	19	47.5

Symptomatology

In our group of 40 renal units, we recorded the presence of lumbar colic pain in the absence of urinary infection, episodes in 13 patients (32.5%). Urinary infection was noted in 14 patients (35%).

Alterations in renal morphology

Pelvis diameter recorded values were between 14 and 64 mm, with a mean of 31.11 mm. Diameter over 3 cm was found in 29 renal units, representing an incidence of 72.5%. 13 patients have experienced a high variability of pelvis dimensions dur-

ing different examinations, with more elevated values in the context of hydration, that were associated with colicky episodes. One constant element was the dilated caliceal appearance.

TABLE 3. Incidence of pelvis dilatation

Pelvis diameter	No of patients (n)	Percentage (%)
> 3 cm	29	72.5
< 3 cm	11	27.5

Renal parenchyma, in the context of variability with patient's age, presents little relevance. The recorded values were between 2.5 mm and 15 mm. For a correct interpretation of renal parenchymal damage, we used the relative value of its thickness, by reporting the pathological value to the normal value corresponding to the age of the patient. These anatomical values were collected from tables giving kidneys average dimensions by age. Reporting to hypothetical normal values is preferable than reporting to contralateral kidney dimensions, as contralateral renal compensatory hypertrophy tend to overestimate parenchymal destruction in the kidney with PUJO (1).

TABLE 4. Incidence of renal parenchymal destruction

Relative parenchymal thickness	No of patients (n)	Percentage (%)
< 50%	26	65
50%-80%	3	7.5
> 80%	11	27.5

Pelvis-cortex index was calculated as the ratio of the anterior-posterior diameter of the pelvis and width of the parenchyma, which comprises both characteristics of the kidney (2). In the study group, we recorded an average of 6.34, with 2.13 and 25.6 as extremes.

Alterations in renal function

Renal functionality was analyzed after DTPA renal scintigraphy, monitoring the split renal function and appearance of the scintigraphic curve. Scintigraphic imaging was performed in 33 renal units, for 82.5% of subjects. All surgical patients had obstructive curve and 11 patients had responded positively to the administration of furosemide.

Split renal function was found between 7 and 49%; values over 40% were found in 13 patients: 11 patients presented incomplete pyelo-ureteral obstruction due aberrant polar vessel and 2 patients presented bilateral hydronephrosis. 20 renal units presented split renal functions lower than 40% and progressive renal impairment.

TABLE 5. Renal function impairment

Split renal function	No of patients (n)	Percentage (%)
< 40%	20	60
> 40%	13	40

Analyzing the criteria for surgical intervention, we found that the most common criteria for surgical indication is the pelvis diameter over 3 cm, followed by alteration below 50% of the thickness of parenchyma, renal impairment below 40% and finally symptomatic criteria – urinary infections and lumbar colicky pain (Fig. 1).

There is a statistically significant correlation of renal function impairment with morphologic alterations (dilated pelvis and reduced parenchyma thickness). Impaired renal function correlates better with altered renal parenchyma than with pelvis dilatation. (Spearman test is considered statistically significant $p < 0.05$)

Relative parenchymal thickness <50% (n=21)	Split renal function <40% (n=20)	$p = 0.00003$
Pelvis diameter > 3 cm (n=24)	Split renal function <40% (n=20)	$p = 0,04172$

(statistically significant $p < 0.05$)

Surgical indication was established by 4 criteria in 6 cases, 3 criteria in 12 cases, two criteria in 18 cases and a single criterion in 4 cases.

TABLE 6. Number of the criteria in determining surgical indication

No of criteria	No of renal units unități renale	Percentage
1	n = 4	10 %
2	n = 18	45 %
3	n = 12	30 %
4	n = 6	15 %

Most frequent were the cases that presented two criteria – 45%, followed by three criteria – 30% and 4 criteria – 15%. One single criterion has been

identified in the case of 4 renal units: 2 cases of incomplete obstruction due to polar vessel (the surgical indication was based on persistent colicky flank pain) and 1 patient with bilateral hydronephrosis (surgical indication was based on a progressive pelvis dilatation; due to bilateral lesion, split renal function was not used as a criterion).

DISCUSSIONS

Young age (under 1 year old) and low-weight children (under 10 kilos) are not contraindications or reasons to delay classical or laparoscopic surgical treatment for PUJO. In our study, they were represented in a proportion of 17.5% and 22.5% respectively.

An important subgroup is represented by the partial pyeloureteric junction obstruction due to aberrant polar vessels. Surgical indication for these patients is most often determined despite a normal kidney function and a parenchyma with minimal damage. One of the features of these patients is the presence of a significant pelvis dilatation with oscillating values that correlate with lumbar colicky episodes, in the context of increased fluid ingestion. Renal scintigraphy shows an obstructive curve with a positive response to diuretics.

The indication for surgery was based on a single criterion, in cases of incomplete pyeloureteral junction obstruction due to aberrant vessels and in case of bilateral hydronephrosis. The number of criteria correlates with severity of renal damage; the presence of all the criteria is not necessary in determining the necessity of surgical intervention. Elements of the utmost importance in terms of lesion severity and potential progressive renal impairment are renal parenchyma thickness and renal function that have a strong correlation between them.

The common element in urological diseases is urinary tract dilatation and the most easy to quan-

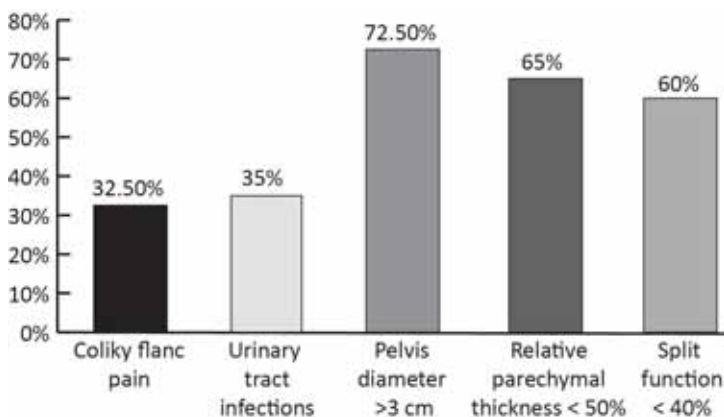


FIGURE 1. Criteria for surgical intervention

tify it is the anterior-posterior diameter of the pelvis. Pyelectasis is the starting point in assessing a child with hydronephrosis, though this is not specific to PUJO. It does not always mean obstruction and does not always show a strong correlation with impaired renal function. (3)

CONCLUSIONS

Although in the literature, apparently there is no accurate quantification of the degree of dilatation that requires surgery, best in establishing therapeutic conduct and necessity of surgical intervention are the magnitude of renal parenchymal restructuring, the degree of renal function impairment and clinical symptomatology (4). Laparoscopic treat-

ment is an effective surgical approach, that meets all the major advantages of minimal invasive surgery, applicable to infants and small children, regardless of age and weight, noting that it requires superior technical equipment and experience in laparoscopic techniques (5).

Within obstructive nephropathy, expressed at histological level by obstructive tubulopathy, dosage of urine markers (epidermal growth factor (EGF), β 2-microglobulin (β 2M)) has opened new possibilities for quantifying renal impairment with a possible decision on necessity for surgery (6). Regarding minimally invasive treatment, robotic pyeloplasty tends to replace laparoscopic techniques, with clear advantages, especially in low weight children (7,8).

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