

Use of internal-external diversion stent in open pyeloplasty in patients under one year of age

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ABSTRACT

Introduction. There are various alternatives available for renal pelvis drainage following pyeloplasty. One of them is the use of an internal-external diversion stent, which according to our protocol, is knotted 48 hours following surgery, prior to discharge, and removed 7 days later on an outpatient consultation basis, with no sedation or analgesia required.

Objective. To analyze the results of patients under one year of age who underwent open pyeloplasty associated with an outpatient internal-external diversion stent.

Materials and methods. A retrospective, descriptive analysis of 28 patients (31 renal units) undergoing surgery from 2011 to 2021 was carried out. Diagnostic methods, indications, surgical approach, and postoperative progression were assessed.

Results. 28 patients (23 male) prenatally diagnosed with hydronephrosis confirmed by ultrasonography and/or renogram underwent pyeloplasty at a median age of 3 months (15 days-11 months). Pyeloplasty was conducted according to the Anderson-Hynes technique or dismembered pyeloplasty in 28 renal units, and according to the Culp-DeWeerd technique or spiral flap in 3. In all cases, an internal-external diversion stent was used according to our protocol. Mean hospital stay was 3.5 days (2-7 days), with a good postoperative progression. 2 patients had complications (urinary infection requiring intravenous antibiotics, and pyonephrosis requiring re-pyeloplasty).

Conclusions. Using an internal-external diversion stent following pyeloplasty in patients under 1 year of age with ureteropelvic junction obstruction is a simple and safe option that allows for early discharge with outpatient management. It also avoids a second general anesthesia for drainage catheter removal purposes.

KEY WORDS: Hydronephrosis; Ureteropelvic junction obstruction; Urologic surgical procedures; Pyeloplasty; Urinary catheters.

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USO DE CATÉTER DE DERIVACIÓN INTERNO-EXTERNO EN LA PIELOPLASTIA ABIERTA EN MENORES DE UN AÑO

RESUMEN

Introducción. Existen diversas alternativas para el drenaje de la pelvis renal tras una pieloplastia. Una de ellas es la utilización de un catéter de derivación interno-externo que, según nuestro protocolo, se anuda a las 48 horas posoperatorias previas al alta y se retira a los siete días de forma ambulatoria en consulta, sin necesidad de sedoanalgesia.

Objetivos. Analizar los resultados de los pacientes menores de un año intervenidos mediante pieloplastia abierta, asociando un catéter de derivación interno-externo de manejo ambulatorio.

Material y métodos. Análisis descriptivo retrospectivo de 28 pacientes (31 unidades renales) intervenidos entre los años 2011 y 2021. Se evaluaron métodos diagnósticos, indicaciones, abordaje quirúrgico y evolución posoperatoria.

Resultados. Veintiocho pacientes (23 varones) con diagnóstico prenatal de hidronefrosis confirmado con ecografía y/o renograma, fueron intervenidos mediante pieloplastia a una mediana de edad de tres meses (15 días-11 meses). Se realizó pieloplastia según técnica de Anderson-Hynes o pieloplastia desmembrada en 28 unidades renales y según técnica de Culp-DeWeerd o colgajo en espiral en 3. En todos los casos se utilizó un catéter de derivación interno-externo según protocolo. El tiempo medio de ingreso fue 3,5 días (2-7 días) con buena evolución posoperatoria. Dos pacientes presentaron complicaciones (infección urinaria que requirió antibioterapia intravenosa y pionefrosis que requirió repieloplastia).

Conclusiones. Asociar un catéter de derivación interno-externo a la pieloplastia en pacientes menores de un año con estenosis de la unión pieloureteral es una opción sencilla y segura que permite un alta precoz con manejo ambulatorio y evita una segunda anestesia general para la retirada del catéter de drenaje.

PALABRAS CLAVE: Hidronefrosis; Obstrucción de la unión pieloureteral; Procedimientos quirúrgicos urológicos; Pieloplastia; Catéteres urinarios.

INTRODUCTION

Prenatally diagnosed hydronephrosis is present in up to 5% of pregnancies⁽¹⁾. Its main cause is ureteropelvic junction obstruction (UPJO), which is a congenital alteration of the

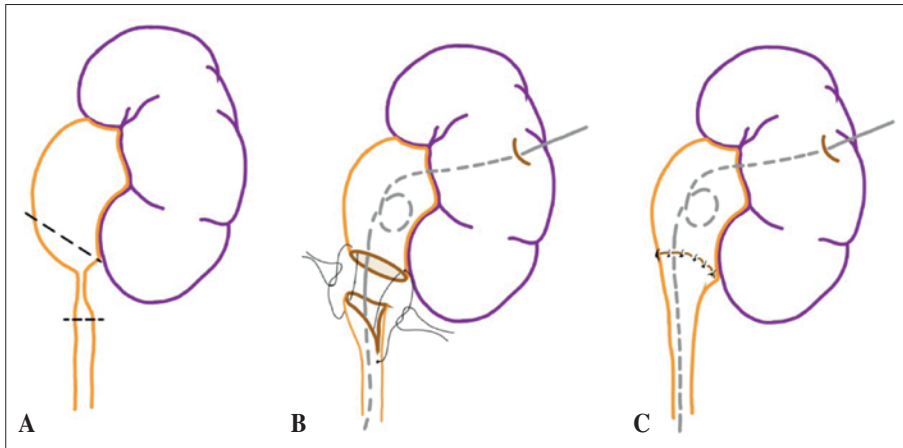


Figure 1. Anderson-Hynes dismembered pyeloplasty. (A) Resection of ureteropelvic junction obstruction. (B) Ureteral spatulation and beginning of anastomosis, internal-external diversion stent normally positioned in the lumen of the urinary tract, with the proximal loop in the pelvis and the proximal side through the renal parenchyma. (C) Ureteropelvic anastomosis completed. (Image courtesy of Manuel Gálvez).

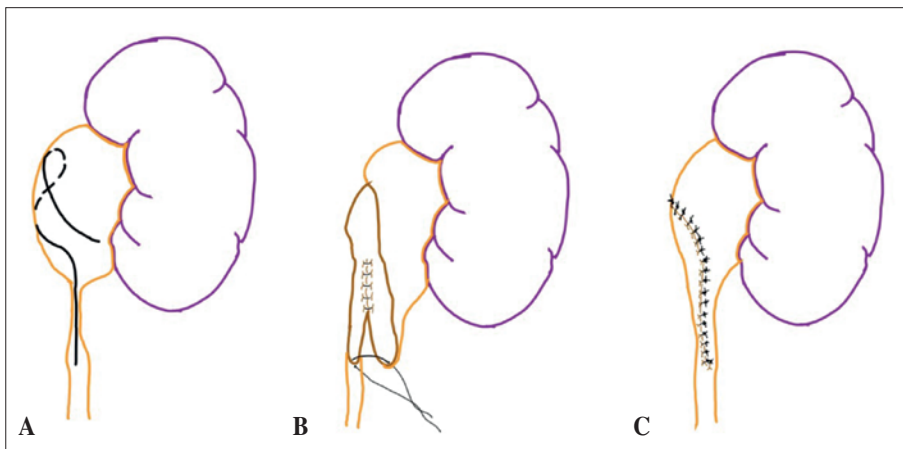


Figure 2. Culp-DeWeerd pyeloplasty with spiral flap. (A) Spiral flap design. The base is located outside the ureteropelvic junction; therefore, the ureteral incision should outreach the obstruction distally. (B) Flap rotation inferiorly and beginning of anastomosis. (C) Anastomosis completed. (Image courtesy of Manuel Gálvez).

upper urinary tract and the most frequent obstructive urological pathology^(2,3). Pyeloplasty – namely the technique published by Anderson-Hynes in 1949⁽⁴⁾ – remains the treatment of choice, with success rates of approximately 90%⁽⁵⁾. There are various alternatives available for renal pelvis drainage in patients undergoing pyeloplasty for the management of UPJO. One of the most common ones is placing a double J internal diversion stent, which is typically removed through cystoscopy on a scheduled basis and under general anesthesia. Another option is the use of an internal-external diversion stent, which does not require general anesthesia for removal purposes. According to the literature, it can be placed both in open and laparoscopic pyeloplasty⁽⁶⁾. The objective of this study was to describe our experience with the use of the internal-external diversion stent following open pyeloplasty in patients under 1 year of age.

MATERIALS AND METHODS

A retrospective review of the clinical records of 28 patients – 31 renal units – who underwent UPJO surgery in our setting from 2011 to 2021 was carried out. All patients

had been prenatally diagnosed with urinary tract dilatation. A postnatal ultrasonography was conducted 72 hours following birth, and a diuretic renogram (MAG-3) was performed at 1 month of life. Both tests confirmed diagnosis.

In all patients, pyeloplasty was carried out via a posterolateral mini-lumbotomy, underneath the 12th rib, with special care not to damage the subcostal package of the 12th rib (artery, vein, and nerve) and of the iliohypogastric nerve. According to surgical findings, either a classic dismembered Anderson-Hynes technique (Fig. 1) or a Culp-DeWeerd pyeloplasty with spiral flap (Fig. 2) was performed – the latter is indicated in the presence of proximal ureteral obstruction associated with UPJO or a large extra-renal pelvis. Magnification glasses (x3) were used, and a 6/0 absorbable monofilament discontinuous suture was applied. Pelvic remodeling was conducted or not as per the surgeon's discretion. In all cases, peri-renal drainage was placed and removed 24 hours later. In all cases, an internal-external diversion stent was placed through the renal parenchyma, and its multi-perforated proximal loop was left in place at the pelvis (Fig. 3). The stent used was a 4 Fr double J urinary stent with an expander, multiperforated in both loops and at the distal end. The proximal end of the expander is

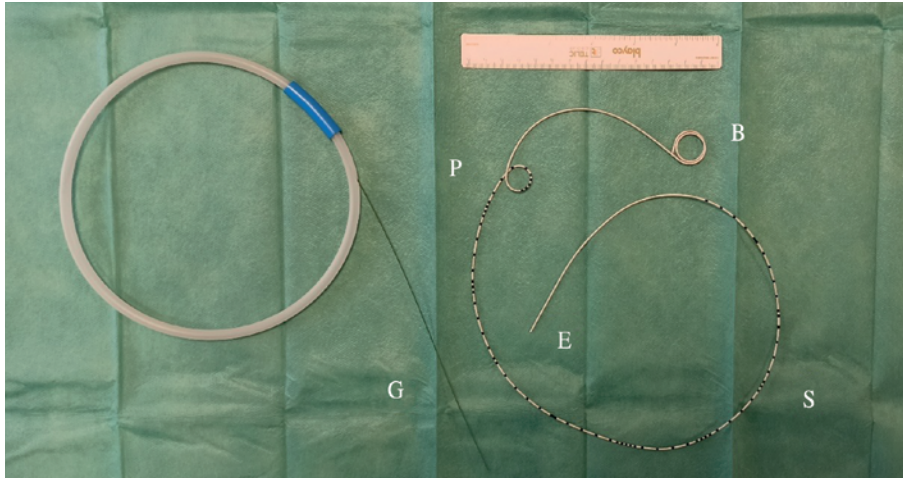


Figure 3. S) 4Ch internal-external diversion stent; B) Bladder multiperforated loop; P) Pelvis multiperforated loop; E) External side; G) Guide wire.

blind to prevent it from bending when passing through the tissue, and it is divided after placement, leaving it open to the urine bag. A 0.021" hydrophilic guide wire (not included) is used to straighten the stent and place the distal loop in the bladder. Passage through the ureterovesical junction tends to be difficult as a result of its narrow diameter. In these cases, the vesical (distal) end of the stent is divided, and it is left in the distal ureter. According to the protocol, the stent is knotted 48 hours following surgery, prior to discharge, and removed 7 days later on an outpatient consultation basis, with no sedation or analgesia required.

Postoperative follow-up was carried out with ultrasonographies – the first one 1 month later, and the following ones according to progression.

The variables studied included ultrasound parameters (pelvic anteroposterior diameter [PAD], bilaterality), renographic parameters (curve type, differential function), surgery-related parameters (indication, age, technique, operating time, hospital stay, complications), and postoperative follow-up parameters (ultrasound progression, follow-up time, postoperative renogram).

For the descriptive analysis of data, the IBM SPSS Statistics Base 22.0 software was used. The analysis was carried out by considering renal units separately.

RESULTS

Over this 10-year period, a total of 28 patients (23 male and 5 female) underwent surgery at a median age of 3 months (15 days-11 months). 31 renal units were analyzed, with 13 right cases, 12 left cases, and 3 bilateral cases. All patients had been prenatally diagnosed with hydronephrosis. Ultrasonography had been conducted at 72 hours of life, and diuretic renogram (MAG-3) had been performed at 1 month of life.

Surgical indication was based on the diuretic renogram, with an obstructive pattern found in 17 renal units, normal

Table 1. Study sample characteristics.

Total n = 28 patients	n (patients)	%
Sex		
- Male	23	82
- Female	5	18
Median age at surgery: 3 months (15 days-11 months)		
Total n = 31 renal units	n (renal units)	%
Laterality		
- Right	13	42
- Left	12	39
- Bilateral	3	19
Surgical indication		
- Diuretic renogram	17	55
- Ultrasound worsening	14	45
Preoperative SFU		
- Grade III	8	26
- Grade IV	23	74
Surgical technique		
- Anderson-Hynes	28	90
- Culp-DeWeerd	3	10
Mean operating time: 101 min (60-130 min)		
<i>SFU: hydronephrosis classification according to the Society for Fetal Urology.</i>		

differential renal function in all cases but three – 36%, 43%, and 43%, respectively –, and ultrasound worsening in 14 renal units, with a median 22 mm (10-50 mm) PAD. Society for Fetal Urology (SFU) preoperative classification was grade IV in 74.2% of patients, and grade III in 25.8% of patients.

Pyeloplasty according to the Anderson-Hynes technique was carried out in 28 renal units, and according to the Culp-DeWeerd technique, in 3 renal units – these cases had long UPJO and hypoplasia of the first ureteral sector. Mean operating time was 101 minutes (60-130 minutes) (Table 1).

Table 2. Progression of renal pelvis diameter.

<i>Renal pelvis anteroposterior diameter</i>		
Preoperative ultrasonography 22 mm (10-50 mm)	1st postoperative ultrasonography 21 mm (8-60 mm)	2nd postoperative ultrasonography 12.6 mm (not visible-25 mm)

In all cases, peri-renal drainage was placed and subsequently removed 24 hours later. In all cases, an internal-external diversion stent knotted 48 hours following surgery was used. Mean hospital stay was 3.5 days (2-7 days). The stent was removed on an outpatient basis 7 days following surgery.

None of the patients had anastomotic leak or postoperative bleeding. 2 patients had early postoperative complications classified as Clavien-Dindo II – urinary tract infection with fever requiring intravenous antibiotic therapy – and IIIb – pyonephrosis secondary to the incidental release of the stent’s distal end through the urethra during the procedure; this re-obstruction required nephrostomy, endo-ureteral dilatation, and re-pyeloplasty –.

Patients have had a good postoperative progression, with a mean follow-up of 43 months (4-101 months). Mean PAD at the first postoperative ultrasonography was 21 mm (8-60 mm), and 12.6 mm (0-25 mm) at the second one (Table 2). In 7 patients, ultrasound progression was not satisfactory, and a new diuretic renogram (MAG-3) was performed. 5 of them had a non-obstructive pattern and a normal differential function, but the other 2 had an obstructive pattern and required re-pyeloplasty – re-obstruction following pyonephrosis or chronic progressive deterioration secondary to an unseen polar vessel.

DISCUSSION

The need for renal pelvis drainage following pyeloplasty is contentious, and determining the most adequate drainage type is an issue of controversy, too. Traditionally, drainage has been used to reduce the risk of urinary leakage, facilitate anastomosis⁽⁷⁾, diminish the risk of transient ureteral obstruction as a result of postoperative edema, and guide the anastomotic healing process, among others⁽⁸⁾. Most teams resort to drainage, with various options available. Two of the most frequent ones are the double J internal stent⁽⁹⁾ and the internal-external diversion stent – the one used in our setting. However, leaving no drainage in place has regained traction, and in the last years, various studies report similar results in pyeloplasties with and without stent⁽¹⁰⁾. According to Xu Liu et al.’s meta-analysis – which includes 15 studies, consists of 1,731 patients, and compares results following pyeloplasty in pediatric patients with double J stent vs. internal-external diversion stent vs. no stent –, there are no significant differences in terms of operating times, operat-

ing success, hospital stay, improvement of renal function, and general complications. The analysis concludes that, in the absence of a stent, the risk of urinary leakage slightly increases, but postoperative pain decreases. Double J stent patients had lower urinary leakage rates but increased urinary tract infections, whereas internal-external diversion stent patients had fewer general complications and less need for re-pyeloplasty⁽⁵⁾. In short, none of the options is ideal or superior to the others according to the literature.

In our setting, we prefer the use of the internal-external diversion stent so as to avoid a second procedure under general anesthesia, which is typically required for double J stent removal purposes⁽¹¹⁾. Indeed, we believe cognitive development risks associated with the repeated use of anesthesia in patients under 3 years of age should be considered⁽¹²⁾. Another alternative described in the literature that avoids a second general anesthesia is the use of magnetic double J stents, which are removed on an outpatient basis through catheterization. However, the minimum catheter size is 4.8 Ch, which represents an important drawback in our age group^(13,14).

Regarding hospital stay, some studies conclude there are no differences in external stent vs. no stent patients⁽¹⁵⁾, and even that the use of stents reduces hospital stay⁽¹¹⁾. In our setting, we prefer to knot the stent and manage it on an outpatient basis, which allows for early discharge. 60% of patients were discharged 3 days or less later, and they presented at the outpatient consultation 7 days following surgery for the scheduled removal of the stent, once the risk of postoperative obstructive anastomotic edema had decreased. At-home stent management has posed no issues for guardians or patients.

In conclusion, using an internal-external diversion stent following pyeloplasty in patients under 1 year of age with UPJO is a simple and safe option that allows for early discharge and outpatient management, while avoiding a second general anesthesia for drainage catheter removal purposes.

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