

Comparative study of cystoscopic control vs. radiological control in the endoscopic treatment of primary obstructive megaureter

J. González Cayón, A. Parente Hernández, A. Ramírez Calazans, V. Vargas Cruz, A. Escassi Gil, R.M. Paredes Esteban

Pediatric Surgery Clinical Management Unit. Hospital Universitario Reina Sofía. Córdoba (Spain).

ABSTRACT

Objective. High-pressure balloon pneumatic dilatation for the treatment of primary obstructive megaureter (POM) was initially described under cystoscopic and radiological control. However, some groups use cystoscopic control only, in an attempt to avoid the ionizing radiation associated with the procedure.

Materials and methods. A retrospective study of POM patients treated with pneumatic dilatation in our unit from 2008 to 2021 was carried out. Success rates, complications, and follow-up were compared between two groups –dilatation under cystoscopic control alone (CS) vs. dilatation under radiological control only (RX).

Results. 23 patients –9 CS and 14 RX– underwent surgery. Both groups were demographically comparable. Mean hospital stay was significantly shorter in the CS group (1 vs. 2 days; $p=0.009$). Operating time was longer in the RX group (78 vs. 30 min; $p=0.001$). Ureterovesical junction (UVJ) dilatation was successful in 100% of CS vs. 79% of RX cases; RR: 3.87 (0.51-26.99). Postoperative complications were similar in both groups; RR: 3.87 (0.51-26.99). Double J stent migration occurred in one case in both groups; RR: 0.64 (0.05-9.03). In the long-term, treatment success rate was higher in the CS group (100% vs. 71%); RR: 3.87 (0.51-26.99).

Conclusion. POM pneumatic dilatation under cystoscopic control alone is faster, without increasing the risk of complications. Based on our experience, we suggest ionizing radiation be removed, since we consider it to be unnecessary.

KEY WORDS: Megaureter; Pneumatic dilatation; Endoscopy; Children.

ESTUDIO COMPARATIVO DEL CONTROL CISTOSCÓPICO VS CONTROL RADIOLÓGICO PARA EL TRATAMIENTO ENDOSCÓPICO DEL MEGAUÉRTER OBSTRUCTIVO PRIMARIO

RESUMEN

Objetivo. La dilatación neumática con balón de alta presión para el tratamiento del megauréter obstructivo primario (MOP) fue descrita inicialmente bajo control cistoscópico y radioscópico. Sin embargo, algunos grupos utilizan únicamente el control cistoscópico, con la intención de evitar la radiación ionizante asociada al procedimiento.

Material y métodos. Estudio retrospectivo que incluye los MOP tratados mediante dilatación neumática en nuestro servicio entre 2008 y 2021. Comparamos tasa de éxito, complicaciones y seguimiento entre dos grupos: dilatación bajo control cistoscópico exclusivo (CS) vs control radioscópico exclusivo (RX).

Resultados. Intervenimos 23 pacientes: 9 CS y 14 RX. Ambos grupos fueron demográficamente comparables. La estancia media hospitalaria fue significativamente menor en el grupo CS (1 vs 2 días; $p=0,009$). El tiempo quirúrgico fue mayor en el grupo RX (78 vs 30 min; $p=0,001$). La dilatación de la unión vesicoureteral (UVU) fue satisfactoria 100% CS vs 79% RX; RR 3,87 (0,51-26,99). Las complicaciones postoperatorias fueron similares para ambos grupos, RR 3,87 (0,51-26,99). La migración del catéter doble J ocurrió en un caso en ambos grupos; RR 0,64 (0,05-9,03). A largo plazo, la tasa de éxito del tratamiento fue mayor para el grupo CS (100% vs 71%); RR 3,87 (0,51-26,99).

Conclusión. La dilatación neumática del MOP bajo control cistoscópico exclusivo es más rápida de realizar, sin aumentar por ello el riesgo de complicaciones. Basándonos en nuestra experiencia, proponemos eliminar la radiación ionizante a los pacientes durante el procedimiento, ya que la consideramos innecesaria.

PALABRAS CLAVE: Megauréter; Dilatación neumática; Endoscopia; Niños.

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Corresponding author: Dr. Jesús González Cayón. Pediatric Surgery Clinical Management Unit. Hospital Universitario Reina Sofía. Avda Menéndez Pidal s/n. 14004 Córdoba.

E-mail address: gonzalezcayonjesus@gmail.com

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INTRODUCTION

The management of primary obstructive megaureter (POM) in the pediatric population has been controversial for a long time, and remains a challenge for pediatric urologists. Treatment is accepted in cases with progres-

sive worsening of hydronephrosis, associated with urinary tract infection (UTI) or loss of renal function⁽¹⁾. Initially, the gold-standard treatment was ureteral reimplantation. However, in patients under 1 year of age, this technique entails high complication rates as a result of its technical complexity, since there is often a significant size discrepancy between the dilated ureter and the small bladder.

Since Angulo et al. first described ureterovesical junction (UVJ) pneumatic dilatation as a treatment of POM⁽²⁾ in 1998, many institutions have considered this minimally invasive technique as the first-line treatment.

The technique initially described consisted of a cystoscopy to identify the ureteral meatus, guide the latter and the ureter with a metallic device, and conduct UVJ dilatation above with a high-pressure balloon. Dilatation was simultaneously controlled under radiological view, while double checking the sagging of the slot that indicated that the stenotic ring had disappeared. Finally, the cranial end of a double J stent was placed over the guide down to the renal pelvis, with the caudal end being left within the bladder, and correct placement was radiologically checked for. However, once the technique had gained traction, and after a long learning curve, the authors realized ionizing radiation could be avoided, and UVJ dilatation could be performed under cystoscopic view alone⁽³⁾.

In light of this, we thought ionizing radiation could be unnecessary and provide no additional benefits during POM pneumatic dilatation. Therefore, decision was made to conduct a comparative study of UVJ dilatation under direct cystoscopic view vs. radiological control alone in the endoscopic pneumatic dilatation of POM. A 6 mm diameter, 2 cm long, 14 atm pressure semi-compliant RX Musso™ Terumo® high-pressure balloon was used in all cases.

MATERIALS AND METHODS

A retrospective, analytical study comparing two POM treatment groups was carried out. In one of the groups (RX), the UVJ was cystoscopy-guided with a metallic device, and subsequently, cystoscopy was given up to conduct dilatation under radiological control only. In the other group (CS), direct cystoscopic view alone was used, both for UVJ dilatation and double J stent placement.

All POM patients undergoing UVJ pneumatic dilatation as the first-line treatment in our unit from 2008 to 2021 were included. The surgical criterion was based on the finding of progressive ureterohydronephrosis, with an obstructive pattern at MAG3 diuretic renogram in the absence of VUR, which was demonstrated through voiding cystourethrography (VCUG).

Demographic and clinical data, preoperative and postoperative ultrasound pelvic and distal ureter diameters, previous renal function, previous renogram, operating time,

Table 1. Demographic characteristics

	RX	CS	p
Boys	71% (10)	78% (7)	>0.05
Girls	29% (4)	22% (2)	>0.05
Mean age (months)	23 ± 28	20 ± 17	0.167

days of double J stent use, hospital stay, and bladder probe duration were collected from electronic medical records. Postoperative and long-term follow-up data included postoperative complications and treatment success or failure. Cases subsequently requiring ureteral reimplantation as a result of treatment failure were also recorded. The parameters studied were retrospectively compared between both groups.

Regarding the statistical analysis, continuous variables were expressed as mean and standard deviation. In normally distributed continuous variables, Student's t-test was used for independent samples, and in non-normally distributed continuous variables, Mann-Whitney's U test was employed. Discrete variables were expressed as frequency and percentage, and they were analyzed using the chi-squared test or Fisher's exact test. Relative risk (RR) was calculated with 95% confidence intervals. Statistical significance was established at $p < 0.05$.

All data was collected in an Excel database, and data processing and statistical analysis was conducted using the SPSS v25.0 software (Chicago, IL, USA).

RESULTS

In our unit, a total of 23 UVJ pneumatic dilatations were conducted in 20 patients from 2008 to 2021. 78% of the cases had prenatally been diagnosed with ureterohydronephrosis. In all study cases, patients had an obstructive pattern at MAG3 diuretic renogram. 61% (14) were dilated through cystoscopic view only (CS), and 39% (9) under radiological control alone (RX). Prior to surgery, 21% of the patients (3) had suffered from UTI in the RX group and 44% (4) in the CS group –3 ITUs and 1 pyonephrosis.

Most of our patients were male (74%), and mean age at surgery was 22 months. Both groups were comparable in terms of demographic characteristics (Table 1).

Preoperative mean function of the affected kidney –estimated through diuretic renograms, all of them with an obstructive pattern–, was $48\% \pm 9.7\%$ in the RX group and $42.4\% \pm 10.6\%$ in the CS group ($p = 0.237$). In the RX group, 6 (43%) patients had a thin renal parenchyma. The ultrasound characteristics of the ureteropelvic system are featured in detail in Table 2, based on the Society of Fetal Urology (SFU)^{s(4)} hydronephrosis grading.

Dilatation was considered successful when the ureteral meatus was catheterized and the stenotic ring was sagged

through pneumatic dilatation during cystoscopy or radiology. Dilatation was successful in 71% of RX and 100% of CS patients; RR: 0.714 (0.51-0.99). Mean operating time was 30 minutes in the CS group and 78 minutes in the RX group ($p=0.001$). Mean hospital stay was longer in the RX group -3 days vs. 1 day on average ($p=0.032$). The double J stent was maintained for a similar number of days in both groups -around two months (77 days RX vs. 65 days CS, $p=0.51$).

Overall, postoperative complications were similar in both groups -43% (6) of RX patients and 30% (7) of CS patients; RR: 3.87 (0.51-26.99). When analyzing complications in detail, post-treatment UTI was more frequent in RX patients -50% (7) vs. 11% (1) of CS patients; RR: 0.56 (0.32-0.99). Double J stent migration occurred in 1 case in both groups; RR: 0.64 (0.05-9.03). 1 patient (7%) from the RX group had postoperative urinoma; RR: 0.93 (0.8-1.07). Postoperative complications are featured in Table 3.

Long-term treatment success was defined as a reduction in ureterohydronephrosis and disappearance of the obstructive pattern at diuretic renogram⁽⁵⁾. Considering

these criteria, long-term treatment success rate was higher in the CS group (89%) vs. the RX group (55%), RR: 0.56 (0.31-0.99). However, it should be noted that follow-up was significantly longer in the RX group (95 ± 13 months) vs. the CS group (25 ± 4 months); $p=0.04$. Such follow-up time difference may have had an impact on the success rate as a result of the learning curve effect in the group of surgeons. In 4 (21%) RX patients, ureteral reimplantation was performed following dilatation, since the latter was regarded as unsuccessful based on the persistence of ureterohydronephrosis and the obstructive curve found at MAG3 diuretic renogram. No ureteral reimplantation was required in the CS group ($p=0.000$). All results achieved are featured in Table 4.

DISCUSSION

Once the initial POM pneumatic dilatation technique had been described, and after a long learning curve that allowed the technique to gain considerable traction, the authors themselves realized the procedure was feasible

Table 2. Ultrasound characteristics

	Preoperative		Postoperative		
	AP pelvic diameter (mm)	Distal ureter diameter (mm)	AP pelvic diameter (mm)	Distal ureter diameter (mm)	
RX	18.64±5.06	13.64±4.22	10.57±8.32	7.64±6.44	
CS	18±7.75	15.56±3.94	3.22±3.27	5.00±3.46	
<i>Preoperative SFU hydronephrosis grading</i>					
	0	1	2	3	4
RX	0	0	0	2	12
CS	0	0	0	1	0
<i>Postoperative SFU hydronephrosis grading</i>					
	0	1	2	3	4
RX	2	2	3	1	6
CS	2	2	4	1	0

Table 3. Postoperative complications

	RX	CS	RR
Overall	43%	30%	3.87 (0.51-26.99)
UTI	50%	11%	0.56 (0.32-0.99)
Double J stent migration	7%	11%	0.64 (0.05-9.03)
Urinoma	7%	0%	0.93 (0.8-1.07)

Table 4. Results

	RX	CS	Statistical significance
Successful dilatation	71%	100%	RR 3.87 (0.51-26.99)
Operating time (min)	90	39	p 0.002
Mean hospital stay (days)	3	1	p 0.032
Doble J stent duration (days)	77	65	p 0.51
Long-term treatment success	89%	55%	RR 0.56 (0.31-0.99)
Follow-up time (months)	95 ± 13	25 ± 4	p 0.04

under cystoscopic view alone, thus avoiding unnecessary radiations in most patients. Since 2011, Doctor Angulo et al.'s team have conducted balloon dilatation without radiological control, since retrograde ureteropyelography through a narrow meatus can sometimes prove challenging. It can also cause greater mucosal inflammation, edema, and bleeding, thus complicating the endoscopic procedure. In light of this, they accepted to avoid the use of ionizing radiation, which provides no additional benefits according to them. Therefore, they only use radiological control in selected cases, which means the double J stent does not necessarily reach the renal pelvis, but remains "in situ" within the dilated ureter and the bladder. Complications associated with this procedure have not demonstrated to be greater⁽³⁾.

In our unit, UVJ pneumatic dilatation for POM treatment used to be carried out by guiding the meatus and the ureter using a metallic device through cystoscopy, and from then on, cystoscopy was given up. Subsequently, UVJ pneumatic dilatation was conducted under radiological view alone, while double checking the slot had disappeared at radiological imaging. However, following the idea proposed by Angulo et al., dilatation has been performed under direct cystoscopic view alone since 2019, which is the reason why this comparative study was decided upon –apart from confirming the findings reported in the latest publications. Even though we initially thought that not placing the caudal end of the double J stent within the renal pelvis could bring about complications, this turned out not to be the case, since its use is equally effective. Similarly to Angulo et al., we found dilatation under cystoscopic view alone to be quicker, to cause similar complications, and to allow ionizing radiation to be avoided.

When analyzing our results, it could be concluded that patients in whom ionizing radiation was not used have had a better long-term progression. However, this does not seem logical, since our hypothesis is only based on the fact ionizing radiation is unnecessary, not on the fact its use may impair dilatation. Given that this study was a retrospective one, with groups being consecutive and not parallel, the technique's learning curve may have favored

these results, which stands as one of the main study limitations. In addition, follow-up times were considerably different between both groups, which may have had an impact when underestimating the potential long-term failure of CS patients. Nevertheless, according to the current literature, POM dilatation is considered to be successful when differential renal function remains stable after 1 year of follow-up⁽⁶⁾, and in all patients from both groups, renal function was higher. Therefore, we believe positing that radiology worsens results is not a valid hypothesis, but we do think it is unnecessary in most procedures, which means it should only be used in selected cases.

Endourology was born as a modern, innovative field, and even though it is quite recent, it allows patients to benefit from minimally invasive treatments that are capable of solving their problems. Advances are still to be made in these young techniques, which are open to changes so that surgeries are increasingly less invasive, while preserving effectiveness. Assuming the limitations of our study as a result of its retrospective nature, we suggest new prospective, randomized studies be carried out to confirm our results.

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