

# Contemporary Open Ureteral Reimplantation Without Morphine: Assessment of Pain and Outcomes

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**Purpose:** The recent literature places significant emphasis on decreased pain and length of stay after endoscopic treatment of vesicoureteral reflux compared to historical open ureteroneocystostomy. We documented postoperative pain and outcomes of a contemporary series of minimally invasive ureteral reimplantation.

**Materials and Methods:** For 100 consecutive patients who underwent ureteroneocystostomy we examined the association of the variables patient age, weight, gender, reflux grade, year of surgery, extravesical or intravesical approach and operative time with the outcomes length of hospital stay and pain score (0 to 10), with univariate linear and multivariate regression analyses.

**Results:** Mean patient age was 5.5 years and median followup was 16 months. All patients received ketorolac and acetaminophen with codeine for pain, and early in the series 7 patients received morphine. Average pain scores were mean 1.2, median 0.9 and maximum 3.4. Mean length of stay was 24.4 hours. Multiple regression analyses demonstrated that date of surgery, lower weight, intravesical approach and operative time were independently associated with greater length of stay. A total of 26 patients underwent voiding cystourethrography postoperatively. There was 1 case of recurrent (from bilateral grade V to unilateral grade I) and 1 case of de novo (contralateral grade I) reflux.

**Conclusions:** Open ureteroneocystostomy can be performed in a minimally invasive manner. A small incision combined with administration of ketorolac is associated with a short length of stay and low pain scores. When comparing endoscopic and open treatment of reflux investigators should consider the high success rate and low morbidity of contemporary, minimally invasive open series.

**Key Words:** length of stay, pain, ureter, urologic surgical procedures, vesico-ureteral reflux

VESICoureteral reflux, the most common urological abnormality in children, occurs in 1% to 2% percent of the pediatric population and in 30% to 40% of children presenting with urinary tract infection.<sup>1,2</sup> Treatment options for reflux include active surveillance with prophylactic antibiotics plus scheduled voiding cystourethrogram, endoscopic treatment with dextranomer/hyaluronic acid copolymer plus scheduled voiding cystourethro-

gram and open surgical correction. Ureteroneocystostomy is considered the gold standard for treatment of vesicoureteral reflux, with success rates of 95% for grades I to IV and 80% for grade V reflux.<sup>3</sup> With Food and Drug Administration approval of dextranomer/hyaluronic acid, and tested safety and durability outcomes in Europe,<sup>4,5</sup> endoscopy has emerged as a popular form of therapy for reflux in the United States.

## Abbreviations and Acronyms

LOS = length of stay

PRN = as needed

UTI = urinary tract infection

VUR = vesicoureteral reflux

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Parental preference for dextranomer/hyaluronic acid is based on its potential advantages over open surgical correction, including less pain, decreased convalescence, fewer complications and improved esthetics. Regarding efficacy, treatment of low grade or unilateral VUR has been shown to be effective.<sup>6</sup> However, while some have reported high success with a single injection of dextranomer/hyaluronic acid,<sup>6,7</sup> many children with high grade VUR or bilateral disease require multiple injections.

Parental preference for endoscopic treatment over open surgical correction of VUR is based on the association of ureteroneocystostomy with extended hospitalization, increased postoperative pain, prolonged convalescence and noticeable scarring.<sup>8</sup> LOS reported in the European literature is generally longer. Similarly comparison studies of endoscopic and open treatment tend to cite extended LOS in the open cohort. Documentation of pain following ureteroneocystostomy is lacking, and the few reports evaluating pain concern the use of spinal anesthesia.

We examined the relationship of analgesic use, patient age, gender, reflux laterality and intravesical vs extravesical approach with postoperative pain and length of hospital stay. We also sought to exemplify the results of a contemporary, minimally invasive open series to serve as a more suitable benchmark for contemporary endoscopy.

## PATIENTS AND METHODS

We reviewed the records of 8 boys and 92 girls who underwent open ureteral reimplantation by a single surgeon (EAK) between 2001 and 2007. Procedures performed elsewhere were excluded from study due to differences in pain scales. Intravesical and extravesical repairs were performed through a 4 cm transverse suprapubic incision. All patients received 0.25% bupivacaine subcutaneously with 1:200,000 epinephrine before skin closure. No caudal or spinal anesthetic was administered. Operative time was measured per anesthesia records.

All patients received 0.5 mg/kg ketorolac every 6 hours and 0.2 to 0.4 ml/kg acetaminophen with codeine as needed for pain. Patients received oxybutynin for 24 hours. Postoperative pain was assessed by nursing staff according to the Nursing Assessment of Pain Intensity, Wong-Baker Faces and Word-Graphics pain scales. These tools are designed to assess pain in age groups 0 to 3, 3 to 7 and older than 7 years, respectively. Pain scales defined pain as mild (0 to 3), moderate (4 to 7) and severe (8 to 10), and scores were assessed every 15 minutes in the post-anesthesia care unit and every 4 hours on the ward. Mean, median and maximum pain scores were calculated.

All patients had a Foley catheter left indwelling overnight. Patients were given a regular diet postoperatively. Children were discharged home when they tolerated a regular diet and pain was well controlled. LOS was measured in hours from end of surgery to discharge home.

Data extracted from the medical records included patient and treatment variables of age, weight, gender, VUR

grade, history of preoperative and postoperative UTI, postoperative imaging, morphine order status, codeine use, intravesical vs extravesical approach and operative time, and outcome data regarding pain scores and LOS. Problematic preoperative infections were defined as 3 or more UTIs, at least 2 associated with fever, within 12 months of surgery despite prophylaxis. Renal sonography was performed at 6 weeks and 1 year postoperatively. Antibiotics were discontinued at 6 weeks. Patients with preoperative grade V reflux or a postoperative UTI underwent cystography.

We used linear regression to determine the effect of patient characteristics, operative factors and analgesic use on mean pain score and LOS. Variables that reached a significance level of 0.4 on linear regression analyses were included in the multivariate regression model. Statistical analyses were performed using Stata®, version 10.0. Goodness of fit was verified with analysis of residual plots.

## RESULTS

Mean patient age was 5.5 years, mean weight was 22 kg and median followup was 16 months. Among the 165 ureters repaired VUR was grade I in 9, II in 24, III in 57, IV in 47 and V in 15. An additional 13 ureters were reimplanted for other anomalies. Of the 60 bilateral repairs 58 (97%) were performed through an intravesical approach, while among the 40 unilateral repairs 31 (78%) were done extravesically. Before 2003, 8 patients received postoperative ketorolac, acetaminophen with codeine PRN and morphine PRN per postoperative orders. Six patients (75%) with an initial morphine PRN order received morphine. By comparison, only 1 (1%) of the 92 patients not prescribed morphine required the drug postoperatively. Mean, median and maximum pain scores for all patients were 1.2, 0.9 and 3.4 (scale 0 to 10), respectively. Average LOS was 24.4 hours and mean codeine requirement was 1.7 mg/kg (equivalent to 2 to 3 doses).

### Univariate Analyses

Univariate analyses revealed that only 1 variable was associated with pain scores (table 1). A total of 42 patients underwent surgery between 2001 and 2004, and 58 underwent surgery between 2005 and 2007. Patients in the early treatment group had a

**Table 1.** Patient variables and pain scores after ureteroneocystostomy

Variables	Mean Pain	Median Pain	Max Pain	LOS
Age	0.82	0.66	0.78	0.07
Gender	0.98	0.96	0.74	0.19
Wt	0.94	0.92	0.92	0.05*
Surgery yr	0.07	0.24	0.008*	0.48
Operative time	0.84	0.85	0.99	0.008*
Morphine order	0.32	0.15	0.76	0.38
Intravesical approach	0.42	0.70	0.13	0.02*

\* p < 0.05.

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