Ureteropelvic Junction Obstruction

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Purpose: We quantified the burden of ureteropelvic junction obstruction in the United States by identifying trends in the use of health care resources and estimating the economic impact of the disease.

Materials and Methods: The analytical methods used to generate these results were described previously.

Results: Inpatient hospitalization rates were highest in children younger than 3 years. Most patients were male and hospitalizations occurred almost exclusively at urban centers. Patients with a primary diagnosis of ureteropelvic junction obstruction between 1994 and 2000 had an overall decrease in the age adjusted rate of inpatient hospitalization from 1.1/100,000 to 0.8/100,000. Physician office visits by Medicare beneficiaries with ureteropelvic junction obstruction as the primary diagnosis showed stable overall age adjusted rates during the reported years. Between 1999 and 2003 mean inpatient length of stay and cost per child hospitalized with the primary diagnosis of ureteropelvic junction obstruction was 2.9 days and $7,728, respectively. Average length of stay decreased more for children than for adults but total inpatient spending remained stable at about $12 million.

Conclusions: The majority of ureteropelvic junction obstructions are diagnosed in the perinatal period. Surgical intervention for pediatric patients has decreased with time, while there has been an increasing trend toward the conservative management of this condition.

Key Words: ureter, ureteral obstruction, kidney, cost and cost analysis, health care costs

Ureteropelvic junction obstruction typically refers to blockage at the junction of the renal pelvis and the beginning of the ureter. The etiology of UPJ obstruction includes congenital and acquired conditions. Most cases are congenital due to an intrinsic and/or extrinsic cause with approximately 13,000 newborns each year in the United States diagnosed with this condition.[1] Acquired conditions include stone disease, postoperative or inflammatory strictures and urothelial neoplasms. Before the introduction of routine perinatal imaging the majority of patients with UPJ obstruction were symptomatic at presentation. The introduction of perinatal sonographic screening dramatically changed the presentation and treatment of UPJ obstruction. Most cases of congenital UPJ obstructions are now diagnosed in the prenatal period. Historically there was a trend toward early surgical intervention with the hope of preserving renal function.[2] However, since 1988, management for prenatally diagnosed UPJ obstruction in select cases has changed from surgical intervention to observation.[3] The goal of surgery is relief of symptoms and/or the preservation of renal function but it is becoming clear that some asymptomatic cases of UPJ obstruction may be followed conservatively. We quantified the burden of UPJ obstruction in the United States by identifying trends in the use of health care resources and estimating the economic impact of the disease.

MATERIALS AND METHODS

The analytical methods used to generate these results were described previously.[4,5]

RESULTS

Trends in Health Care Use

Inpatient care. According to HCUP KID for 1997 and 2000 the rate of inpatient hospitalizations of patients younger than 18 years for UPJ obstruction remained unchanged at 2.4/100,000 population (table 1). KID is based on a sample of pediatric discharges from community hospitals in the United States. Since it samples only pediatric discharges, KID allows more in-depth analysis of pediatric resource use than that available in the all ages HCUP data set. KID for 1997 and 2000 includes 2,521 hospitals from 22 states and 2,784 hospitals from 27, respectively. Hospitalization rates were highest in children younger than 3 years in 1997 and 2000 at 8.8/100,000 and 9.3/100,000, respectively. In 1997 and 2000 the majority of patients were male (71% and 72%, respectively) and hospitalizations occurred almost exclusively at urban centers. Hospitalization rates in the Midwest and South were consistently lower than those in the Northeast and West.

HCUP data on patients with a primary diagnosis of UPJ obstruction for 1994 to 2000 revealed an overall decrease in the age adjusted rate of inpatient hospitalization from 1.1/100,000 to 0.8/100,000 population (table 2). These data included adults and children and yet the trend was seen only

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TABLE 1. *Inpatient hospital stays for UPJ obstruction as primary diagnosis in 1997 and 2000*

	1997		2000	
	Count	Rate (95% CI)	Count	Rate (95% CI)
Totals	1,696	2.4 (2.0–2.7)	1,725	2.4 (1.9–2.8)
Age (yrs):				
Younger than 3	1,036	8.8 (7.3–10)	1,089	9.3 (7.3–11)
3–10	433	1.3 (1.0–1.6)	432	1.3 (1.0–1.6)
11–17	227	0.8 (0.6–1.0)	204	0.7 (0.5–1.0)
Sex:				
M	1,197	3.3 (2.7–3.8)	1,250	3.4 (2.8–4.0)
F	498	1.4 (1.2–1.7)	476	1.4 (1.0–1.7)
Region:				
Midwest	334	2.0 (1.4–2.6)	322	1.9 (0.8–2.9)
Northeast	399	3.0 (1.8–4.2)	420	3.2 (1.8–4.7)
South	471	1.9 (1.2–2.7)	541	2.2 (1.4–3.0)
West	491	2.9 (2.1–3.8)	443	2.6 (1.6–3.4)
MSA:				
Rural	43	*	60	*
Urban	1,653	3.0 (2.6–3.5)	1,650	2.9 (2.4–3.5)

Rate per 100,000 based on 1997 or 2000 population estimates from CPS, CPS Utilities, Unicon Research Corp. for relevant demographic categories of civilian noninstitutionalized population younger than 18 years in the United States, and individuals of other races, and with missing race and ethnicity, and missing MSA included in the total (counts may not sum to total due to rounding and race/ethnicity breakdown not included because of large percent of missing values in 1997 or 2000) (source: HCUP KID, 1997 and 2000).
* Value does not meet reliability or precision standard.

in patients younger than 18 years. The overall rate for these patients decreased from 2.8/100,000 to 1.7/100,000 population. The rate of inpatient hospitalizations for patients 18 years or older varied minimally during 1994, 1996, 1998 and 2000 at 0.60/100,000, 0.60/100,000, 0.50/100,000 and 0.50/100,000 population, respectively (table 2). Hospitalization rates were greater for males than for females in all years reported at 60%, 66%, 65% and 58%, respectively, according to calculations based on data in table 2. The hospitalization rate appeared lower than that reported in male patients younger than 18 years, which would suggest a greater incidence of acquired UPJ obstructions in female patients or an increased likelihood for female patients to become symptomatic from congenital UPJ obstruction as they become older. Hospitalization rates in the West were consistently less than those in the Northeast, Midwest and South. Data also indicated that white individuals had the highest rate of hospitalization in all study years except 1996, in which Hispanic individuals had the highest rate. Most hospital admissions occurred in urban areas.

The database from the National Association of Children's Hospitals and Related Institutions from 1999 to 2003 showed mean inpatient LOS for admissions associated with a diagnosis of UPJ obstruction in the pediatric population (table 3). Mean LOS during this period was 2.9 days. LOS was similar in all age groups. LOS was longer in males than in females (3.0 vs 2.7 days). LOS was greatest in the Northeast, and least in the Midwest and South (3.5 vs 2.7 days). According to HCUP data mean hospital LOS for admissions associated with a primary diagnosis of UPJ obstruction consistently decreased from 5 days in 1994 to 3.3 days in 2000 (table 4). The longest LOS of 4.8 days occurred in the age group of 45 years or older and the shortest of 2.8 days occurred in the pediatric age group of younger than 18 years. Mean LOS was longest in the black American population and hospitalizations tended to be longer in rural than in urban areas. Mean LOS was longest in the South and shortest in the West (3.6 vs 2.6 days). Between 1994 and 2000 LOS decreased further for children than for adults (table 4). Of the patients 63% were younger than 2 years at the time of treatment. This was similar to the trend in HCUP KID, in

TABLE 2. *Inpatient hospital stays for UPJ obstruction as primary diagnosis*

	1994			1996			1998			2000		
	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate
Totals	2,821	1.1 (0.9–1.3)	1.1	2,663	1.0 (0.8–1.2)	1.0	2,304	0.9 (0.7–1.0)	0.9	2,215	0.8 (0.6–1.0)	0.8
Age:												
Younger than 18	1,900	2.8 (2.1–3.4)		1,701	2.4 (1.8–3.0)		1,332	1.9 (1.3–2.4)		1,228	1.7 (1.1–2.3)	
Older than 18		0.6			0.6			0.5			0.5	
18–24	158	0.6 (0.4–0.9)		170	0.7 (0.4–0.9)		225	0.9 (0.6–1.2)		185	0.7 (0.5–1.0)	
25–34	225	0.6 (0.4–0.7)		263	0.6 (0.4–0.8)		173	0.4 (0.3–0.6)		167	0.4 (0.3–0.6)	
35–44	228	0.6 (0.4–0.8)		164	*		175	0.4 (0.3–0.5)		229	0.5 (0.4–0.7)	
45+	295	0.4 (0.3–0.5)		365	0.4 (0.3–0.6)		394	0.4 (0.3–0.6)		406	0.4 (0.3–0.6)	
Sex:												
M	1,690	1.4 (1.1–1.7)	1.3	1,745	1.4 (1.1–1.6)	1.3	1,492	1.1 (0.9–1.4)	1.1	1,288	1.0 (0.7–1.2)	0.9
F	1,131	0.9 (0.7–1.0)	0.9	918	0.7 (0.5–0.8)	0.7	812	0.6 (0.5–0.7)	0.6	927	0.7 (0.5–0.8)	0.7
Race/ethnicity:												
White	1,677	0.9 (0.7–1.1)	1.0	1,563	0.8 (0.6–1.0)	0.9	1,332	0.7 (0.5–0.8)	0.7	1,218	0.6 (0.5–0.8)	0.7
Black	242	0.8 (0.5–1.0)	0.6	185	0.6 (0.3–0.8)	0.5	*	*	*	156	0.4 (0.2–0.7)	0.4
Hispanic	211	*	0.7	322	1.1 (0.7–1.6)	0.9	*	*	*	169	0.5 (0.2–0.8)	0.4
Region:												
Midwest	833	1.4 (1.0–1.7)	1.4	737	1.2 (0.8–1.6)	1.2	623	1.0 (0.7–1.3)	1.0	590	0.9 (0.6–1.2)	0.9
Northeast	516	1.0 (0.6–1.4)	1.0	506	1.0 (0.6–1.4)	1.0	521	*	1.1	424	0.8 (0.5–1.1)	0.8
South	1,111	1.3 (0.8–1.8)	1.3	950	1.0 (0.7–1.4)	1.0	777	0.8 (0.6–1.1)	0.8	644	0.7 (0.4–0.9)	0.7
West	360	0.6 (0.4–0.8)	0.6	470	0.8 (0.5–1.1)	0.8	383	0.6 (0.3–1.0)	0.6	558	*	0.9
MSA:												
Rural	269	0.4 (0.3–0.6)	0.4	272	0.5 (0.3–0.6)	0.4	235	0.4 (0.2–0.6)	0.4	166	0.3 (0.2–0.4)	0.3
Urban	2,552	1.4 (1.1–1.6)	1.3	2,391	1.2 (0.9–1.4)	1.2	2,055	1.0 (0.8–1.2)	1.0	2,049	1.0 (0.7–1.2)	1.0

Rate per 100,000 based on 1994, 1996, 1998 and 2000 population estimates from CPS, CPS Utilities, Unicon Research Corp. for relevant demographic categories of civilian noninstitutionalized population in the United States, age adjusted rate adjusted to the United States Census derived age distribution of the year under analysis, and individuals of other races, and with missing or unavailable race and ethnicity, and missing MSA included in the total (counts may not sum to total due to rounding) (source: HCUP Nationwide Inpatient Sample, 1994, 1996, 1998 and 2000).
* Value does not meet reliability or precision standard.

TABLE 3. *Inpatient LOS and cost per child admitted with UPJ obstruction as primary diagnosis in 1999 to 2003*

	Count (%)	Mean LOS (days)	Mean Cost/Pt ($)
Totals	3,078	2.9	7,728
Age (yrs):			
0–2	1,933 (63)	2.9	7,649
3–10	795 (26)	2.8	7,525
11–17	329 (11)	3.0	8,660
18 or Older	21 (1)	3.0	8,154
Race/ethnicity:			
Asian	37 (1)	3.2	7,925
Black	286 (9)	3.2	7,703
Hispanic	333 (11)	3.5	8,542
Missing	142 (5)	1.9	5,807
Other	267 (9)	3.1	8,243
White	2,007 (65)	2.7	7,659
North American native	6 (0)	2.5	8,064
Sex:			
F	920 (30)	2.7	7,372
M	2,158 (70)	3.0	7,880
Region:			
Northeast	489 (16)	3.5	9,581
Midwest	993 (32)	2.7	7,651
South	1,065 (35)	2.7	6,930
West	531 (17)	2.9	7,767

Primary diagnosis using International Classification of Diseases, 9th revision codes 753.20 and 753.21 (source: National Association of Children's Hospitals and Related Institutions, 1999 to 2003).

which the highest rate of inpatient hospitalizations was for children younger than 3 years (table 1).

Outpatient care. An individual may be seen in the outpatient setting as part of the diagnosis of UPJ obstruction for medical evaluation and prevention. We focused on visits for which UPJ obstruction was the primary diagnosis.

Table 5 shows data on physician office visits by Medicare beneficiaries with UPJ obstruction as the primary diagnosis in 1992, 1995, 1998 and 2001. The overall age adjusted physician office visit rate for patients older than 65 years remained relatively unchanged during the reported years (7.6/100,000, 6.8/100,000, 7.7/100,000 and 7.3/100,000 population, respectively). Interestingly females had the highest rate of physician office visits in this population and the trend was increasing (64%, 63%, 77% and 76%, respectively) according to calculations based on data in table 5. These data coincided with data in the HCUP data set for patients older than 18 years. In 1998 and 2001 the rates were highest for Asian individuals and lowest for black Americans.

Economic Impact

Data on the cost of treating patients with UPJ obstruction are limited. However, National Association of Children's Hospitals and Related Institutions data suggest that the average cost per hospitalization from 1999 to 2003 was $7,728 (table 3). The 11 to 17-year-old age group had the highest mean cost at $8,660. Treatment costs for children remained considerably higher in the Northeast, whereas the South had the lowest mean cost ($9,581 vs $6,930). While average LOS associated with UPJ obstruction treatment decreased markedly with time, National Ambulatory and Medical Care Survey data on 1994 to 2000 revealed no change in aggregate expenditures during those years. LOS may have decreased but there was at most a small decrease in total inpatient spending from $12.1 million to $11.8 million (table 6).

DISCUSSION

UPJ obstruction is a condition in which urine is unable to travel from renal pelvis to bladder secondary to blockage occurring at the UPJ. Although hydronephrosis secondary to UPJ obstruction can lead to progressive renal deterioration, the clinical dilemma is when this is significant enough to

TABLE 4. *LOS for patients with primary diagnosis of UPJ obstruction*

	1994				1996				1998				2000			
	Count	Mean LOS (days)	Median LOS (days)	Max LOS (days)	Count	Mean LOS (days)	Median LOS (days)	Max LOS (days)	Count	Mean LOS (days)	Median LOS (days)	Max LOS (days)	Count	Mean LOS (days)	Median LOS (days)	Max LOS (days)
Totals	2,821	5	4	111	2,663	3.8	3	34	2,304	3.5	3	17	2,215	3.3	3	42
Age:																
Younger than 18	1,900	5.3	4	111	1,701	3.9	3	34	1,332	3.3	3	17	1,228	2.8	2	16
18–24	158	4.2	5	9	170	3.1	3	7	225	3.8	4	9	185	3	3	9
25–34	225	4	4	11	263	3.5	3	14	173	3.8	3	8	167	3.3	3	8
35–44	228	3.9	4	9	*	*	*	*	175	3.3	3	7	229	3.4	3	9
45 or Older	295	5.4	5	24	365	4.2	4	17	394	4.1	3	17	406	4.8	4	42
Sex:																
M	1,690	5.1	4	111	1,745	3.8	3	34	1,492	3.4	3	17	1,288	3.3	3	42
F	1,131	5	4	21	918	3.8	3	19	812	3.8	3	17	927	3.3	3	12
Race/ethnicity:																
White	1,677	5	4	111	1,563	3.8	3	17	1,332	3.5	3	17	1,218	3.7	3	16
Black	242	5.6	4	18	185	5.4	4	34	*	*	*	*	156	3.4	3	10
Hispanic	211	5.4	5	16	322	4.2	3	30	*	*	*	*	169	3.3	3	10
Region:																
Northeast	516	6.5	4	111	506	4.3	3	34	521	3.7	3	17	424	3.3	3	10
Midwest	833	4.7	4	24	737	3.6	3	17	623	3.5	3	17	590	3.5	3	42
South	1,111	4.9	4	20	950	3.6	3	19	777	3.5	3	12	644	3.6	3	16
West	360	4.1	4	15	470	4	4	30	383	3.5	3	13	558	2.6	2	7
MSA:																
Rural	269	3.5	4	8	272	3.4	3	8	235	3.6	3	17	166	4.3	4	12
Urban	2,552	5.2	4	111	2,391	3.9	3	34	2,055	3.5	3	17	2,049	3.2	3	42

Civilian noninstitutionalized population in the United States and individuals of other races, and with missing or unavailable race and ethnicity, and missing MSA included in the total (counts may not sum to total due to rounding) (source: HCUP Nationwide Inpatient Sample, 1994, 1996, 1998 and 2000).
* Value does not meet reliability or precision standard.

TABLE 5. *Physician office visits by Medicare beneficiaries with UPJ obstruction as primary diagnosis*

	1992			1995			1998			2001		
	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate	Count	Rate (95% CI)	Age Adjusted Rate
Totals	2,320	6.6 (5.4–7.9)		2,200	6.2 (5.1–7.4)		2,360	7.0 (5.8–8.3)		2,260	6.4 (5.2–7.6)	
Total 65 or older	2,120	7.2 (5.8–8.6)	7.6	2,000	6.8 (5.5–8.2)	6.8	2,100	7.7 (6.2–9.2)	7.7	2,100	7.4 (6.0–8.9)	7.3
Age:												
65–69	340	3.8 (2.0–5.6)		360	4.3 (2.3–6.2)		400	5.5 (3.1–7.8)		440	5.8 (3.4–8.3)	
70–74	500	6.6 (4.0–8.2)		760	9.8 (6.7–13)		780	11 (7.6–15)		480	6.9 (4.1–9.7)	
75–79	680	12 (7.9–16)		460	8.1 (4.8–11)		400	7.1 (4.0–10)		460	7.7 (4.6–11)	
80–84	520	14 (8.4–19)		220	5.6 (2.3–8.9)		320	8.3 (4.2–12)		420	10 (5.9–15)	
85–89	60	2.9 (0.0–6.2)		140	6.4 (1.7–11)		160	7.3 (2.2–12)		160	6.9 (2.1–12)	
95 or Older	20	2.4 (0.0–7.1)		20	2.2 (0.0–6.6)		20	2.2 (0.0–6.5)		100	10 (1.3–20)	
Race/ethnicity:												
White	1,580	5.3 (4.2–6.5)	5.6	1,640	5.4 (4.2–6.6)	5.2	2,140	7.5 (6.1–9.0)	7.5	2,000	6.7 (5.4–8.0)	6.9
Black	120	4.0 (0.8–7.3)	4.7	160	5.0 (1.5–8.4)	6.2	60	1.9 (0.0–4.1)	1.9	60	1.8 (0.0–3.8)	1.2
Asian	Not available	Not available	Not available	0	0.0	0.0	120	38 (7.6–69)	38	180	38 (13–63)	25
Hispanic	Not available	Not available	Not available	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
North American native	Not available	Not available	Not available	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Sex:												
M	840	5.6 (3.9–7.3)	6.3	820	5.4 (3.7–7.0)	5.9	540	3.7 (2.3–5.1)	4.1	540	3.5 (2.2–4.8)	3.8
F	1,480	7.4 (5.7–9.1)	6.9	1,380	6.8 (5.2–8.5)	6.4	1,820	9.6 (7.6–12)	9.1	1,720	8.7 (6.8–10)	8.4
Region:												
Midwest	300	3.4 (1.7–5.2)	3.0	180	2.0 (0.7–3.3)	1.8	720	8.3 (5.6–11.1)	8.1	420	4.8 (2.7–6.8)	4.8
Northeast	440	5.7 (3.3–8.1)	6.8	540	7.0 (4.4–9.7)	7.0	300	4.5 (2.2–6.7)	4.5	360	5.2 (2.8–7.6)	4.6
South	1,440	12 (9.1–14)	11	840	6.6 (4.6–8.6)	6.8	840	6.8 (4.7–8.8)	7.1	980	7.4 (5.3–9.5)	8.1
West	100	1.8 (0.2–3.4)	1.8	640	12 (8.1–17)	12	500	10 (6.1–14)	9.7	500	9.3 (5.6–13)	8.1

Unweighted counts multiplied by 20 to arrive at values, rate per 100,000 Medicare beneficiaries in the same demographic stratum, age adjusted rate adjusted to the 2000 United States Census and individuals of other races, unknown race and ethnicity, and other region included in the totals (counts less than 600 should be interpreted with caution) (source: Centers for Medicare and Medicaid Services, 5% Carrier and Outpatient Files, 1992, 1995, 1998 and 2001).

TABLE 6. *Inpatient expenditures for UPJ obstruction*

	Total Expenditures ($)
1994	12,073,190
1996	12,274,483
1998	11,279,536
2000	11,747,477

Source: National Ambulatory and Medical Care Survey, National Hospital and Ambulatory Medical Care Survey, HCUP and Medical Expenditure Panel Survey, 1994, 1996, 1998 and 2000.

warrant repair. Before the introduction of routine imaging during the perinatal period, the majority of patients diagnosed with a UPJ obstruction were symptomatic at presentation. The introduction of perinatal sonographic screening in the 1980s dramatically changed the presentation and treatment of UPJ obstruction. The majority of congenital cases of UPJ obstructions are now diagnosed in the prenatal period. The debate over the optimal management for prenatal hydronephrosis has been ongoing since the introduction of practical prenatal sonographic screening in the 1980s.[6] Historically there was a trend toward early surgical intervention with the hope of preserving renal function.[2] Capello et al recently used the New York State Department of Health database to identify patients who underwent pyeloplasty between 1984 and 2002.[7] In this study the annual rate of repair in patients younger than 1 year increased from 94/100,000 to 156/100,000 live births between 1984 to 1988 and 1989 to 2002, suggesting that prenatal ultrasound has led to the earlier diagnosis of UPJ obstruction, allowing earlier repair and obviating later repair. However, since 1988, management for prenatally diagnosed UPJ obstruction in select cases has changed from surgical intervention to observation because many patients seem to do well without aggressive surgical intervention and many urologists prefer to avoid procedures in these young patients.[3] The goal of surgery is relief of symptoms and/or preservation of renal function but it is becoming clear that some asymptomatic cases of UPJ obstruction may be followed conservatively.

Access to HCUP data may help confirm these practice patterns and further elucidate the natural history of asymptomatic UPJ obstruction followed conservatively. Current practice trends suggest that the majority of UPJ obstructions are managed early in life as a result of prenatal screening. Currently many patients born before the era of perinatal sonographic screening are now presenting with UPJ obstruction that manifests during a diuretic event, often caused by coffee or alcohol. If perinatal sonographic screening is successful for detecting congenital UPJ obstruction and patients who require intervention are treated during childhood, the number of adults hospitalized for this condition should decrease in the future. The exception would be patients with acquired UPJ obstruction. Moreover, the increasing trend toward conservative management for congenital UPJ obstruction may result in these patients becoming susceptible to precipitating events later in life that can convert asymptomatic to symptomatic UPJ obstruction.

Our data on the rate of inpatient hospitalizations of pediatric patients parallel those recently reported by Nelson et al in an analysis of HCUP data on patients younger than 18 years between 1988 and 2000.[8] In this study 70.7% of the patients were male and they tended to be younger at surgery (60.1 vs 69.4 months). The proportion of procedures performed during the first 6 months of life decreased from 34.2% (1988 to 1991) to 25.2% (1997 to 2000). In addition, the percent of procedures done at urban teaching hospitals increased significantly from 48.9% (1988 to 1991) to 61.3% (1997 to 2000). These investigators concluded that between 1988 and 2000 the decrease in procedures performed in newborns suggested that patients with prenatal hydronephrosis were increasingly undergoing observation instead of early surgery.

Our KID data show that inpatient hospitalizations for pediatric patients occur almost exclusively at urban centers. The reasons for this trend are likely multifactorial. Changes in financial reimbursement may have made it less cost-efficient for practitioners in rural areas to perform subspecialized procedures such as pediatric pyeloplasty. The emergence of laparoscopic pyeloplasty may be another possible factor. Although the number of urologists performing laparoscopic pyeloplasty continues to grow, they still represent a minority, which may mean that more patients migrate to busy urban centers in search of this or other minimally invasive techniques.

Our HCUP data on patients with a primary diagnosis of UPJ obstruction revealed an overall decrease in the age adjusted rate of inpatient hospitalization. This may reflect the trend toward conservative treatment in certain patients with perinatally diagnosed asymptomatic UPJ obstruction. The rates of inpatient hospitalizations for patients 18 years or older varied minimally, which is not unexpected, since these patients were born before the era of routine sonographic screening. Data on patients born after the initiation of prenatal screening would be expected to show a lower rate of hospitalization for UPJ obstruction. LOS decreased further in children than in adults. Nelson et al observed a decrease from 6.6 days (1988 to 1991) to 3.7 days (1997 to 2000).[8] These data would suggest a further decrease in LOS between 2000 and 2003.

A wide range of factors has been reported to have an impact on LOS following treatment for UPJ obstruction, including use of care pathways and protocols, specialty consultation, level of use of imaging technology, legislation and evolution of surgical technique.[8,9] Standard repair for UPJ obstruction was historically open pyeloplasty. During the years numerous minimally invasive options became available. Many of these endourological procedures, including percutaneous endopyelotomy,[10,11] "cautery wire balloon" endopyelotomy[11,12] and ureteroscopic endopyelotomy,[13] are associated with decreased hospital LOS and postoperative recovery. Unfortunately the success rate for many of them does not approach the rate of open pyeloplasty.[14,15] However, laparoscopic pyeloplasty is proving to offer the success rate of an open procedure with the decreased morbidity of an endourological procedure.[16] Laparoscopic procedures are commonly promoted as resulting in shorter hospital stays, which was demonstrated to be the case with pyeloplasty.[15] However, due to the lack of appropriately sized instruments many minimally invasive techniques are not available for pediatric patients.

While the average LOS associated with UPJ obstruction treatment decreased markedly with time, National Ambulatory and Medical Care Survey data on 1994 to 2000 reveal no change in aggregate expenditures during those years. LOS may have decreased but there has been at most a small

decrease in total inpatient spending. It may be that inpatient services were moved to ambulatory surgery locations, making the overall picture hard to estimate from the data. Additionally, reimbursement for inpatient stays may have decreased in parallel with decreasing LOS but the charges may have been artificially inflated for gaming reasons, thus, masking the decrease. Average treatment costs for children remain considerably higher in some regions, which may be due to the increasing costs associated with laparoscopy and other minimally invasive procedures. The failure of inflation adjusted charges to decrease with decreasing LOS suggests that other cost pressures are increasing the overall cost of surgical care, which may include increased hospital overhead and personnel costs, increased equipment and pharmaceutical costs, and increasing malpractice insurance costs.[17,18] However, our study is limited in the ability to differentiate the types of surgical procedure performed.

The treatment choice for UPJ obstruction must be based on several factors, including the success and morbidity of the procedure, surgeon experience and patient choice. In the last decade treatment for UPJ obstruction shifted from open pyeloplasty to endopyelotomy to laparoscopic pyeloplasty.[19,20] A survey of 56 academic endourologists revealed that 2 factors shown to affect the success of endopyelotomy adversely, that is crossing vessels and significant hydronephrosis, were the basis for choosing pyeloplasty over endopyelotomy by approximately 80% of the respondents.[19] A recent survey to determine practice patterns in surgical treatment for UPJ obstruction among urologists in the United States indicated that the presence of a crossing vessel was an important factor for determining UPJ obstruction management.[20] Community urologists preferred open pyeloplasty, whereas academic urologists preferred laparoscopic pyeloplasty. Surgeon training and experience were the most influential factors in choosing the surgical approach.

Treatment cost is another factor to consider when deciding on an optimal course of treatment. A decision tree model was used to estimate the cost of treatment and followup for antegrade endopyelotomy, retrograde ureteroscopic endopyelotomy, cautery wire balloon endopyelotomy, laparoscopic pyeloplasty and open pyeloplasty at a single treatment center.[21] Primary cost variables for UPJ obstruction treatments were operative time, hospital LOS, equipment cost and success rate. Decision tree analysis showed that retrograde ureteroscopic or cautery wire balloon endopyelotomy was the most cost-effective treatment modality at the study institution.

CONCLUSIONS

Surgery to correct UPJ obstruction has evolved with time. Most congenital cases of UPJ obstructions are being diagnosed in the perinatal period. The practice of surgical intervention for pediatric patients has decreased, while there has been an increasing trend toward conservative management. LOS has decreased, which is consistent with broader trends in medicine, although inflation adjusted hospital charges failed to decrease significantly, as would be expected from shorter hospital stays.

Abbreviations and Acronyms

CPS	=	Current Population Survey
HCUP	=	Health Care Cost and Utilization Project
KID	=	Kids' Inpatient Database
LOS	=	length of stay
MSA	=	metropolitan statistical area
UPJ	=	ureteropelvic junction

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