

PRENATAL ULTRASOUND HAS LED TO EARLIER DETECTION AND REPAIR OF URETEROPELVIC JUNCTION OBSTRUCTION

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ABSTRACT

Purpose: We hypothesized that the widespread adoption of prenatal ultrasound in the early 1980s has led to earlier and increased numbers of repairs for ureteropelvic junction (UPJ) obstruction.

Materials and Methods: The New York State Department of Health database was used to identify all patients who underwent pyeloplasty between 1984 and 2002.

Results: A total of 7,758 repairs were evaluated (6,725 pyeloplasties and 1,033 endopyelotomies). There was no substantial change in the rate of repair when adjusted for age specific population during the study period. The annual rate of repair in patients younger than 1 year increased from 94 to 156 per 100,000 live births between the periods 1984 to 1988 and 1989 to 2002. This same upward trend was seen in the children 1 to 9 years old. In contrast, there was a substantial decrease in the rate of repairs in patients 10 to 19 years old and in those 20 to 29 years old (from 10 to 9 per 100,000 and from 12 to 8 per 100,000 population, respectively). The male-to-female ratio of newborns in our series was approximately 3:1, which is consistent with previous reports. Among older patients males underwent fewer repairs such that the male-to-female ratio in patients older than 30 years was 1:2.

Conclusions: The overall rate of UPJ repair has not changed during the last 19 years, but there has been a substantial trend toward repair at an earlier age. This finding suggests that prenatal ultrasound has led to earlier diagnosis of UPJ obstruction, allowing earlier repair and obviating later repair. We also report the novel finding of a decreasing rate of pyeloplasty in males with age. This decrease was not observed in females.

KEY WORDS: ureter, ureteral obstruction, urologic surgical procedures, prenatal diagnosis

Before the introduction of prenatal ultrasound patients with ureteropelvic junction (UPJ) obstruction usually presented for medical attention due to a palpable flank mass, flank pain, hematuria or urinary tract infection. However, the widespread use of ultrasound for prenatal screening has changed the manner in which UPJ obstruction is diagnosed. Currently, most significant obstructions seen in newborns are detected prenatally.

Prenatal ultrasound became widely adopted for screening in the United States in the early 1980s. In the year 2000 ultrasound examinations were performed in an estimated 67% of pregnancies resulting in live births in the United States.¹ Prenatal hydronephrosis is found in 1.4% to 4.5% of screening ultrasounds,^{2–4} and UPJ obstruction is the cause of hydronephrosis in up to 41% of cases.^{5,6}

In 1995 Wiener et al published a study investigating whether rates of pyeloplasty changed after the introduction of screening prenatal ultrasound at 3 hospitals in North Carolina.⁷ They found an overall increase in the number of pyeloplasties performed between 1970 and 1992. After 1981, with the adoption of prenatal ultrasound in that region, they noted an increase in repairs in the first year of life, and a slight decrease in pyeloplasties performed in patients older than 7 years. To our knowledge no other report has been published addressing whether the rate and timing of pyelo-

plasties have changed since the introduction of routine prenatal ultrasound screening.

Based on the widespread use of prenatal ultrasound, we believe that more children are likely to undergo pyeloplasty early in life than in the past. This practice might lead to several trends. First, it is possible that children operated on early in life might never have symptoms and, therefore, may undergo pyeloplasty for a clinically insignificant obstruction. If this were the case, there would be an overall increase in the rate of pyeloplasty. On the other hand, early diagnosis and repair may prevent the development of symptoms later in life, and, therefore, decrease the rate of pyeloplasty in late childhood and during adulthood. The purpose of this study was to examine retrospectively the number of pyeloplasties performed in New York State during the last 19 years, and to determine whether the overall rate and timing of pyeloplasty have changed since the adoption of prenatal ultrasound.

METHODS

The New York State Department of Health maintains the Statewide Planning and Research Cooperative System database, which was initiated in 1984 and which contains identified inpatient data for all admissions to New York State hospitals. This database was queried to identify all hospitalizations between 1984 and 2002 that were assigned the International Classification of Disease (ICD) procedure code for pyeloplasty (5587) or endopyelotomy (5511). To decrease potential coding errors, patients who did not have a concurrent diagnosis consistent with UPJ obstruction were excluded.

The overall number of UPJ repairs performed was calculated for each year in the study period for patients of all ages. All repairs were then segregated into 4 periods—1984 to

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1988, 1989 to 1993, 1994 to 1998 and 1999 to 2002—for comparison through time. To adjust for population changes, the rate of repair for each period was divided by the age specific population for the year of repair, obtained from the United States Census Bureau, and expressed as number of repairs per 100,000 population.

Linear regression analysis was performed on the proportion of total cases in each age group for each year of repair. Slope and r^2 values were calculated to determine the statistical fit of the data to the regression line for that group.

RESULTS

An ICD procedure code of 5587 (pyeloplasty) was assigned to 7,746 hospitalizations, and 5511 (endopyelotomy) to 2,568 hospitalizations. However, 2,556 patients did not have a diagnosis code consistent with UPJ obstruction, raising the possibility of coding errors or nonobstructing indications for the procedure, such as pyelotomy for stone disease. Therefore, these patients were excluded from the study. However, to be certain that we were not excluding important data, the data were analyzed with and without these patients and the results were not significantly different (data not shown). Overall, 7,758 repairs were included in the study—6,725 pyeloplasties and 1,033 endopyelotomies. There were 4,114 males and 3,644 females.

Figure 1 demonstrates the rate of repair per 100,000 population as a function of year of repair. This graph reveals that the overall rate of pyeloplasty, when corrected for population, has not changed substantially in New York State during the last 19 years.

With regard to the timing of repair figure 2 shows the average annual rate of repair during each period for several different age categories. It is noteworthy that the first age category (surgery before age 1 year) contains 1 patient-year, whereas the others contain 9 patient-years (surgery at age 1 to 9 years) or 10 patient-years (all other groups). In those undergoing surgery before age 1 year there was a significant trend toward more pyeloplasties with time (fig. 2). That is there were more repairs in this age group in 1999 to 2002 than there were in 1984 to 1988. Figure 3 better demonstrates repair curves in patients 1 year and older. The group undergoing pyeloplasty at age 1 to 9 years also exhibited a trend toward increasing repairs with time but this trend was not as pronounced as in patients younger than 1 year. In contrast, there was a decrease in the number of repairs performed at ages 10 to 19 years and 20 to 29 years. In patients older than 40 years there was no significant change in rate of repair except for a decrease in the 1999 to 2002 period.

The proportion of repairs performed in patients younger than 1 year and in patients 20 to 29 years old as a function of year of repair were then compared (fig. 4). This comparison again revealed that the proportion of patients treated before age 1 year increased substantially from the start of the study, especially from 1984 to 1992. Linear regression analysis for

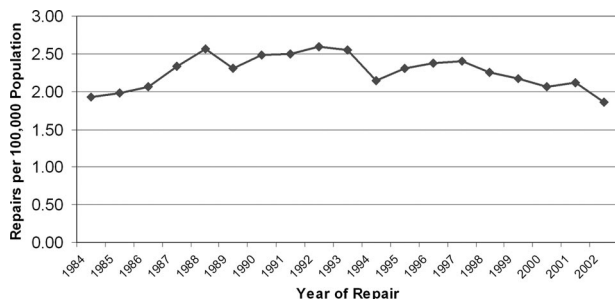


FIG. 1. Rate of pyeloplasty per 100,000 population in New York State from 1984 to 2002.

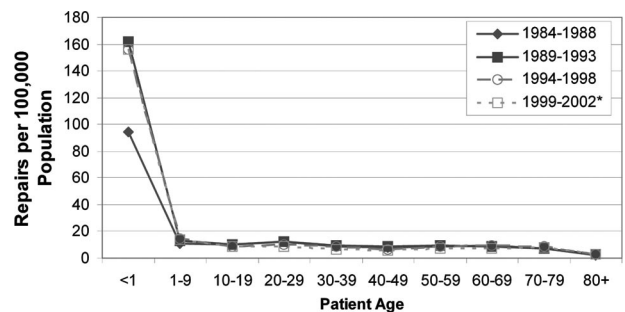


FIG. 2. Rate of repair per 100,000 population as function of age at repair for each study period in patients of all ages.

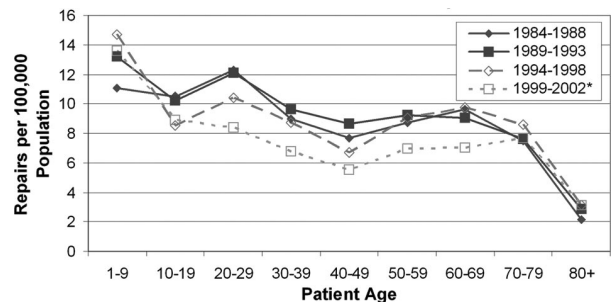


FIG. 3. Rate of repair per 100,000 population as function of age at repair for each study period for all patients 1 year or older.

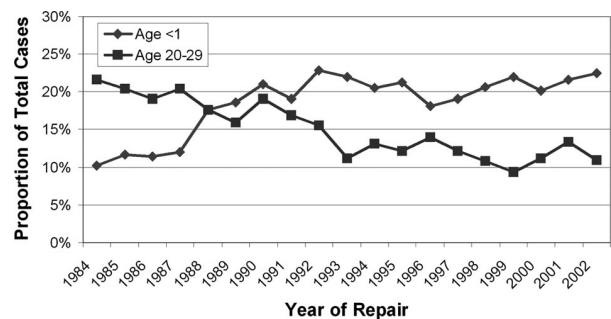


FIG. 4. Proportion of repairs performed in patients younger than 1 year and in patients 20 to 29 years old as function of year of repair.

patients younger than 1 year who underwent repair between 1984 and 1992 showed a slope of 1.6% per year with an r^2 value of 0.90. In contrast, analysis of patients 20 to 29 years old who underwent repair between 1984 and 1992 demonstrated a slope of -0.66% per year with an r^2 value of 0.71. When all patients undergoing repair before age 1 year were considered from 1984 to 2002 the slope was 0.56% per year with an r^2 value of 0.60. Analysis of repairs performed in patients 20 to 29 years old from 1984 to 2002 revealed a slope of -0.61% per year with an r^2 value of 0.71.

Incidentally, a trend regarding gender and rate of repair became apparent (fig. 5). In the newborn period the male-to-female ratio was approximately 3:1. Also, males more commonly underwent repair at younger ages and less often when older. Conversely, females had a fairly constant rate of repair, and in the older groups females had a higher rate of pyeloplasty than males. Therefore, the male-to-female ratio in those older than 30 years reversed and became 1:2. These trends were similar for each period studied.

DISCUSSION

There has been a significant increase in the prenatal diagnosis of hydronephrosis since the adoption of ultrasound for

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