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LOWER REPRODUCTIVE TRACT FISTULA REPAIRS IN INPATIENT US WOMEN, 1979-2006

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Abstract

Objective—To characterize trends in lower reproductive tract fistula (LRTF) repair in inpatient US women from 1979-2006.

Methods—Retrospective data was obtained from the National Hospital Discharge Survey regarding LRTF diagnoses, demographics, comorbidities, and fistula repair procedures, using *ICD-9-CM* diagnostic and procedure codes. Age-adjusted rates (AARs) were calculated using 1990 census data. Trends in LRTF surgical repair were evaluated using regression analysis.

Results—Between 1979 and 2006, the AAR of LRTF repair declined from 7.8 to 4.8 per 100,000 women ($b = -2.97$, $p < 0.001$). The most common surgical fistula repairs were rectovaginal, vesicovaginal, and colovaginal. The AARs of colovaginal and vesicovaginal fistula repair remained stable, while the AAR of rectovaginal fistula repair declined.

Conclusions—The AAR of inpatient LRTF repair declined between 1979 and 2006, perhaps reflecting a concurrent decrease in obstetric trauma, in the context of decreasing episiotomy and operative vaginal delivery and increasing Cesarean section rates.

Keywords

colovaginal fistula; hospital discharge data; rectovaginal fistula; surgical repair; vesicovaginal fistula

Introduction

A fistula is an abnormal connection between two epithelialized surfaces, which may develop following aberrant healing after trauma or inflammation. Fistulas may develop between the lower reproductive tract (vagina, cervix, uterus) and the gastrointestinal tract (large or small

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bowel), genitourinary system (bladder, urethra, ureters), or external skin (perineum, labia, buttocks). Lower reproductive tract fistulas (LRTF) may result from pelvic surgery, obstetric trauma, gastrointestinal disease, malignancy, radiation therapy, or inflammatory disease [1, 2]. A LRTF may very rarely result from vaginal trauma related to coitus or the prolonged presence of a foreign body [3,4].

Pelvic surgery involving the bowels, bladder, uterus or vagina may lead to fistula formation, especially when concomitant hysterectomy and bowel resection are performed, when stapling devices are used, or when perineal or vaginal mesh is placed [5]. Vesicovaginal fistulas in the developed world are often associated with pelvic surgery, especially hysterectomy; in the developing world they are often associated with obstructed labor and obstetric trauma [2, 6].

Obstetric trauma and inflammatory bowel disease are the most common causes of rectovaginal fistula [1, 5]. Obstetric trauma leading to LRTF formation may result from acute perineal laceration related to episiotomy, shoulder dystocia, or operative vaginal delivery, or from prolonged ischemia and necrosis following obstructed labor [1, 2].

Risk factors associated with severe perineal lacerations at the time of vaginal delivery include episiotomy, increasing maternal age, increasing birth weight, primiparity, and assisted vaginal delivery [7]. During the last 25 years in the United States, the rates of episiotomy and operative vaginal delivery have declined dramatically, and the rate of cesarean section has increased [8].

The primary objective of this study was to describe rates of and characterize trends in LRTF repair in inpatient US women between 1979 and 2006. It was our hypothesis that the decrease in episiotomy and operative vaginal delivery over the last 25 years would be reflected by a concurrent decrease in LRTF repair, largely driven by a decrease in rectovaginal fistulas related to obstetric trauma.

Materials and Methods

The National Hospital Discharge Survey (NHDS), compiled by the National Center for Health Statistics, is a national probability sample of short-stay, non-federal US inpatient hospital discharges. Established in 1965 and conducted annually since, the NHDS collects data on approximately 270,000 inpatient records from approximately 500 hospitals [9]. It includes general hospitals and general children's hospitals with at least 6 beds and an average length of stay less than 30 days for all patients; federal, military, Department of Veterans Affairs, and institutional hospitals are excluded [9].

Redesigned in 1988 to incorporate automated data and a three-stage sampling design, the NHDS uses both a manual data abstraction system and an automated system that extracts data from existing electronic records [10]. De-identified demographic information (age, sex, race, ethnicity, marital status, and expected payment sources) are recorded, as are administrative data (admission and discharge dates and status) [9]. Medical information is recorded for each discharge including up to 4 procedure codes and 7 discharge diagnoses, using the International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) coding system [9]. A detailed description of this survey is available elsewhere [10]. Quality control programs have estimated the error rate for the NHDS at 0.3 % for medical (ICD-9-CM) coding and 0.3% for demographic coding and data entry; the overall dataset error rate for final diagnoses is 1.0% and for procedures is 0.7% [10, 11].

This study was reviewed by the University of Pittsburgh Institutional Review Board and was deemed to be exempt. The NHDS dataset was used to abstract retrospective data regarding

patient and hospital demographics, co-morbidities, and relevant surgical repair procedures for women with a diagnosis of LRTF between 1979 and 2006. Women with a diagnosis of LRTF were identified according to ICD-9-CM diagnosis codes outlined in Table 1. Next, those who underwent a surgical repair of LRTF were identified using ICD-9-CM procedure codes (Table 1).

Age-adjusted rates (AARs) of diagnoses and procedures per 100,000 women were calculated by adjusting numbers to estimate national frequencies using specified hospital weights included in the dataset, and then age-adjusting the rates for each year to the U.S. Census population distribution for 1990, the middle decade of the three spanned by our data. Given a large number of hospitalizations associated with an LRTF diagnosis in comparison to a relatively small number of hospitalizations associated with a surgical repair, analyses were focused on women undergoing surgical repair of LRTF. Frequencies were calculated for co-morbidities associated with each of the three most common surgical LRTF repairs. Procedures and diagnoses were counted for each occurrence. For example, if both rectovaginal and vesicovaginal fistula repair were performed during a single hospitalization, those procedures would be tallied individually as 1 rectovaginal fistula repair and 1 vesicovaginal fistula repair, but would count as only 1 LRTF repair overall. If multiple procedures were performed on a single patient over multiple admissions, each individual procedure was counted once. There is no way to control for multiple surgeries on the same patient since the database is deidentified and information is collected for each discharge.

Data were analyzed for trends in AARs of LRTF repair using the linear test of trend. Statistical analyses were performed with SPSS software (version 17.0, SPSS Inc, Chicago, IL). A probability value <0.05 was considered statistically significant.

Results

Between 1979 and 2006, 799,887 inpatient discharges of women with a diagnosis of lower reproductive tract fistula were identified. Of these discharges, 165,128 included a surgical procedure for fistula repair. The three most common surgical fistula repairs were rectovaginal (ICD-9-CM 70.73, $n=81,735$), vesicovaginal (ICD-9-CM 57.84, $n=33,221$), and colovaginal (ICD-9-CM 70.72, $n=17,438$). Table 1 displays the distribution of diagnosis and procedure codes of interest.

Table 2 presents demographics for the sample of all discharges during which any LRTF repair was performed, and for those during which repair of the three most common fistulas was performed. Women undergoing repair of rectovaginal fistula were younger (mean age 36.5 ± 15.0) than women undergoing repair of vesicovaginal (mean age 47.4 ± 15.2) or colovaginal fistula (mean age 68.2 ± 11.0). The majority of women undergoing repair of rectovaginal or vesicovaginal fistula had private insurance, whereas the majority of those undergoing colovaginal fistula repair had government insurance. Distributions were similar by race, region, and hospital size. The vast majority (94%) of women undergoing rectovaginal fistula repair were discharged to home, while a significant portion (15%) of women undergoing colovaginal fistula repair were discharged to long-term acute care facilities. The mortality rate was much higher for women undergoing vesicovaginal fistula repair (4.6%) than for those undergoing colovaginal (1.4%) or rectovaginal (0.4%) repair.

For discharges during which surgical repair of a rectovaginal, vesicovaginal, or colovaginal fistula was performed, the most common concomitant diagnoses are presented in Tables 3-5. Nine percent (7,576/81,735) of discharges during which rectovaginal fistula repair was performed included a diagnosis of post-obstetric complication (Table 3). Twenty-seven percent (8,971/33,221) of discharges during which vesicovaginal fistula repair was

performed included a diagnosis of post-surgical complication (Table 4). Using the umbrella category for gastrointestinal and diverticular disease, 81% (14,080/17,438) of discharges during which colovaginal fistula repair was performed included a diagnosis of gastrointestinal or diverticular disease, as compared to 9% (7,032/81,735) of discharges after rectovaginal fistula repair (Tables 3, 5). Essential hypertension was among the top ten concomitant diagnoses for discharges after each type of fistula repair; diabetes mellitus was among the top ten concomitant diagnoses for rectovaginal and colovaginal fistula repair, while acute myocardial infarction was among the top ten concomitant diagnoses for vesicovaginal fistula repair (Tables 3-5).

The AAR of lower reproductive tract fistula diagnosis in inpatient women overall declined from 35.5 per 100,000 women in 1979 to 22.7 per 100,000 women in 2006. Figures 1 through 4 provide graphic representations of AARs over time for surgical repairs of LRTF. The AAR of lower reproductive tract fistula repair in inpatient women declined from 7.8 to 4.8 per 100,000 women ($b = -2.97$, $p < 0.001$) (Figure 1). While the rates of colovaginal and vesicovaginal fistula repair remained stable over the last two decades (0.6 and 1.2 per 100,000 women, respectively), the rate of rectovaginal fistula repair declined from 3.0 per 100,000 women in 1979 to 2.0 per 100,000 women in 2006, peaking at 5.9 in 1980 (Figures 2 – 4). Given the small frequency of these procedure codes per year, no statistical analysis was performed to test these trends.

Discussion

The overall AAR of LRTF repair in inpatient women declined significantly between 1979 and 2006. While the AARs of vesicovaginal and colovaginal fistula repair remained constant, the AAR of rectovaginal fistula repair declined. Interestingly, the decline in AAR of rectovaginal fistula repair is coincident with previously documented declines in episiotomy, anal sphincter laceration, and operative vaginal delivery, as well as increasing cesarean section rate [8].

The majority of colovaginal fistula repairs were in the context of gastrointestinal disease such as diverticular disease, whereas rectovaginal fistula repairs were associated with gastrointestinal disease and post-obstetric complications in equal proportions. It is likely that the decrease in rectovaginal fistula repair is related to a decrease in post-obstetric trauma rather than a decrease in gastrointestinal and diverticular disease, since the AAR of colovaginal fistula repair remained stable over the study time period.

Women undergoing rectovaginal fistula repairs were significantly younger than women undergoing either vesicovaginal or colovaginal fistula repairs. It is possible that women undergoing repair of rectovaginal fistula were younger than women undergoing repair of vesicovaginal or colovaginal fistulas because their fistulas were related to post-obstetric trauma. More women undergoing repair of colovaginal fistula had government insurance and were discharged to long-term acute care facilities, likely due to their older age.

Women undergoing vesicovaginal fistula repairs had a significantly higher mortality rate than women undergoing other LRTF repairs. The high mortality rate among women undergoing vesicovaginal fistula repair is difficult to explain, but could be related to complications related to underlying medical conditions rather than surgical complications, given the concomitant diagnosis of acute myocardial infarction in 5.2%. Perioperative myocardial infarction is associated with an extremely high mortality rate of 40% [12]. It is also possible that women undergoing vesicovaginal fistula repair have different comorbid conditions that predispose them to a higher mortality rate; of note, personal history of malignancy was among the ten most frequent comorbid conditions for discharges after

vesicovaginal but not colovaginal or rectovaginal fistula repair. Unfortunately, information about specific cause of death is not available in this dataset.

Almost a third of women undergoing vesicovaginal fistula repair carried a concomitant diagnosis of post-surgical complication, as compared to less than 5% of women undergoing rectovaginal fistula repair. This finding is consistent with what has previously been described regarding common etiologies of these fistulas, with vesicovaginal fistulas primarily being related to a prior surgical procedure [1, 2]. It is not surprising that the vast majority of women undergoing repair of colovaginal fistula carried a diagnosis of gastrointestinal or diverticular disease [13].

There is a 5-fold higher number of all inpatient women with the diagnosis of LRTF compared to the number undergoing surgical repair for LRTF. The diagnosis of LRTF with each inpatient admission may represent the initial diagnosis of the fistula, medical treatment related to the fistula (without concurrent surgery), treatment of medical conditions that may have caused the fistula, or hospitalization for an unrelated medical condition where the fistula diagnosis was listed only as an existing medical condition.

There are several important limitations to the data presented here. Despite the large size of the NHDS database, the incidence of LRTF repair is infrequent, such that the relative standard error for trend calculations becomes too large to produce reliable estimates. Therefore, although we are able to demonstrate trends in these data, we are unable to calculate reliable estimates of statistical significance for them. Further, there were significant changes to the NHDS sampling design in 1988, so that it is difficult to assess whether trends are related to true changes in diagnosis and procedure frequency or whether they reflect different data availability. Further, our ascertainment of co-morbid conditions is limited to those that were coded as discharge diagnoses; it is possible that diagnoses related to prior injury (such as post-surgical or post-obstetric complications) would not be coded on a current admission. It is also possible that LRTF repairs are increasingly performed on an outpatient basis, and that the decreasing trend reflects a shift from inpatient to outpatient procedures for this diagnosis, but it is our clinical experience that the majority of LRTF repairs remain inpatient procedures. Further, these data are not generalizable to other settings in which emergency obstetric care is not readily available to all patients, and obstructed labor and midline episiotomy remain prevalent. Despite these limitations, we feel that these data are valuable to present as they are our best estimates of trends in LRTF.

The AAR of lower reproductive tract fistula repair declined between 1979 and 2006, and the AAR of rectovaginal fistula repair had a statistically significant decline between 1979 and 2006. These trends may reflect a decrease in severe obstetric perineal lacerations over this time period, in the context of decreasing use of episiotomy and operative vaginal delivery, and concurrent increasing Cesarean section rate. As the use of minimally invasive techniques for hysterectomy and other female pelvic surgeries continues to evolve, so will these trends. With the increasing use of electronic medical records for inpatient and outpatient care, better access to concomitant diagnoses may be possible, and we may be able to better characterize LRTF etiologies and risk factors in the future.

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Figure 1.
Age-adjusted rates of inpatient lower reproductive tract fistula repair overall in United States women, 1979-2006

Figure 2.
Age-adjusted rates of inpatient rectovaginal fistula repair in United States women, 1979-2006

Figure 3.
Age-adjusted rates of inpatient vesicovaginal fistula repair in United States women, 1979-2006

Figure 4.
Age-adjusted rates of inpatient colovaginal fistula repair in United States women, 1979-2006

Table 1

Frequency of ICD-9-CM Diagnosis and Procedure Codes of Interest

Code	Fistula Diagnosis	Frequency
619	Fistula involving female genital tract	
619.0	Urinary-genital tract fistula female	77,485
619.1	Digestive-genital tract fistula female	278,090
619.2	Genital tract-skin fistula female	10,374
619.8	Other specified fistulas involving female genital tract	20,451
619.9	Unspecified fistula involving female genital tract	3,419
593.82	Ureteral fistula	5,578
599.1	Urethral fistula	19,952
596.2	Vesical fistula, not elsewhere classified	20,288
569.81	Fistula of intestine excluding rectum/anus	232,903
998.6	Persistent post-operative fistula	168,493
	Fistula Repair Procedure	
57.83	Repair of fistula involving bladder and intestine	6,319
57.84	Repair of other fistula involving bladder (including vagina, uterus)	33,221
70.72	Repair of colovaginal fistula	17,438
70.73	Repair of rectovaginal fistula	81,735
70.74	Repair of other vaginoenteric fistula	5,104
	Code	Frequency
70.75	Repair of other vaginal fistula	10,835
56.84	Repair of ureteral fistula	942
58.43	Repair of urethral fistula (including to vagina or perineum)	2,136
67.62	Repair of cervical fistula	49
69.42	Repair of uterine fistula	1,717
71.72	Repair of fistula involving vulva or perineum	5,321
70.79	Repair of old obstetric laceration of vagina	2,648
69.49	Other repair of uterus (including old obstetric laceration)	49
71.79	Other repair of vulva or perineum (including old obstetric laceration)	6,060
67.69	Other repair of cervix (including old obstetric laceration)	60
	Diagnosis Codes for Comorbidities of Interest	
	Gastrointestinal Disease Diagnosis Codes	154,894
555	Regional enteritis (Crohn's Disease, granulomatous enteritis)	
556	Ulcerative colitis	
558	Other and unspecified noninfectious gastroenteritis and colitis (includes radiation-	

	induced, toxic, allergic; excludes infectious)	
562	Diverticula of intestine	
	Post-surgical Diagnosis Codes	169,318
909.3	Late effects of surgical or medical care	
998.6	Persistent post-operative fistula	
	Post-obstetric Diagnosis Codes	8,552
677	Late effect of complication of pregnancy, childbirth, and the puerperium	
660	Obstructed labor	
664	Trauma to the perineum and vulva during delivery	
674.2	Disruption of perineal wound	
	Oncology Diagnosis Codes	
140-239	Malignancy	167,630

Table 2

Demographics of women undergoing lower reproductive tract fistula repair overall, and those undergoing specific surgical repairs

Characteristic	Any LRTF Repair (N=165,128) n (%)	Rectovaginal fistula repair (N=81,735) n (%)	Vesicovaginal fistula repair (N=33,221) n (%)	Colovaginal fistula repair (N=17,438) n (%)
Age (mean, range)	44 (18, 94)	36 (18, 93)	47 (19, 88)	68 (24, 94)
Race				
White	123,587(74.8)	60,556 (74.1)	23,336 (76.3)	13, 514 (77.5)
African-American	14,787 (9.0)	7,369 (9.0)	2,630 (7.9)	1,305 (7.5)
Other	4,721 (2.9)	2,850 (3.5)	1,052 (3.0)	312 (1.8)
Not Stated	22,033 (13.3)	10,960 (13.4)	4,203 (12.7)	2,307 (13.2)
Insurance				
Private	88,928 (54)	47,466 (58.1)	19,289 (58.1)	4,357 (25.0)
Government	57,836 (35)	23,447 (28.7)	11,252 (33.9)	11,627 (66.6)
Other	18,364 (11)	10,822 (13.3)	2,680 (8.1)	1,454 (8.4)
Hospital Size				
<100 beds	19,569 (11.9)	11,104 (14.0)	3,828 (11.5)	1,530 (8.8)
100-199 beds	32,000 (19.4)	17,563 (21.5)	4,525 (13.6)	3,494 (20.0)
200-299 beds	36,427 (22.1)	15,951 (19.5)	6,134 (18.5)	6,188 (35.5)
300-499 beds	42,018 (25.4)	19,931 (24.4)	11,877 (35.8)	2,187 (12.5)
>500 beds	35,114 (21.3)	16,886 (20.7)	6,857 (20.6)	2,060 (11.8)
Status at Discharge				
Routine/home	145,656 (88.2)	76,894 (94.1)	28,763 (86.6)	12,960 (74.3)
Long term acute care facility	6,421 (3.9)	1,750 (2.1)	855 (2.6)	2,716 (15.6)
Short term acute care facility	2,331 (1.4)	101 (0.1)	54 (0.2)	546 (3.1)
Dead	2,114 (1.3)	322 (0.4)	1,520 (4.6)	237 (1.4)
Other/ Not stated	8,606 (5.2)	2,668 (3.3)	2,029 (6.1)	979 (5.6)

LRTF = Lower reproductive tract fistula

Table 3

Most frequent diagnoses among women undergoing repair of rectovaginal fistula (N=81,735)

Frequency	Code	Diagnosis
80,791	619	Fistula involving female genital tract
7,576	V27	Outcome of delivery
4,431	618	Genital prolapse
3,599	787	Symptoms involving digestive system
3,570	562	Diverticula of intestine
3,506	250	Diabetes mellitus
3,397	998	Other complications of procedures not elsewhere classified
2,963	305	Nondependent drugs of abuse
2,796	555	Regional enteritis
2,746	401	Essential hypertension

Table 4

Most frequent diagnoses among women undergoing repair of vesicovaginal fistula (N=33,221)

Frequency	Code	Diagnosis
29,430	619	Fistula involving female genital tract
8,971	998	Other complications of procedures not elsewhere classified
6,797	E87	Other disorders of fluid, electrolyte, and acid-base balance
5,257	596	Other disorders of bladder
2,710	401	Essential hypertension
2,465	788	Symptoms involving urinary system
2,335	599	Other disorders of urethra and urinary tract
2,107	997	Complications affecting specified body system not elsewhere classified
1,720	410	Acute myocardial infarction
1,489	V10	Personal history of malignant neoplasm

Table 5

Most frequent diagnoses among women undergoing repair of colovaginal fistula (N=17,438)

Frequency	Code	Diagnosis
17,483	619	Fistula involving female genital tract
13,066	562	Diverticula of intestine
5,033	569	Other disorders of intestine
3,549	401	Essential hypertension
2,916	568	Other disorders of peritoneum
2,651	276	Hyperosmolality and/or hypernatremia
2,554	997	Complications affecting specific body system not elsewhere classified
1,947	250	Diabetes mellitus
1,727	285	Other and unspecified anemias
1,704	560	Intestinal obstruction without mention of hernia