Using ICD-9 Codes to Identify Indications for Primary and Repeat Cesarean Sections: Agreement with Clinical Records

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ABSTRACT

Aggregate databases are increasingly being used to evaluate appropriateness of care, and, for cesarean sections, Anderson and Lomas' *International Classification of Diseases,* 9th Revision (ICD-9), coding hierarchy is a widely used tool. The aim of this study was to assess the validity of the hierarchy and expand its applicability to repeat cesareans. Hospital records of 1885 singleton cesareans were reviewed. Clinical indications and ICD-9 hierarchical codes were concordant for 83% of primary and 86% of repeat cesareans; modification allowed elective repeat cesareans to be distinguished from indicated procedures. The Anderson and Lomas ICD-9 hierarchy is a valid tool for assessing indications for cesarean. The current modification improves its clinical utility and expands its application to repeat procedures. (*Am J Public Health.* 1995;85:1143–1146)

Introduction

The rapid rise in the rate of cesarean sections since the 1960s has prompted many studies of the causes of the increase and potential means of reducing the rate. Anderson and Lomas[1] developed a hierarchy of *International Classification of Diseases,* 9th Revision, 5th Edition, Clinical Modification (ICD-9),[2] codes to assess indications for cesareans in aggregate databases, and this mutually exclusive hierarchy has become a widely used tool.[3–6] It identifies repeat cesareans first, followed by breech presentations, dystocia, fetal distress, and other indications. Repeat cesareans are grouped and excluded before other indications are assessed, thereby implying that the indications for primary cesarean do not apply. Using Anderson and Lomas' hierarchy, our aim was to assess agreement between indications for cesarean based on ICD-9 codes abstracted by a medical records department and to compare these indications with clinical indications obtained by review of physician and nursing notes. We also wanted to assess the feasibility of expanding the system to apply to repeat cesareans and to evaluate its usefulness in distinguishing elective repeat procedures from those with clinical indications.

Methods

We identified all cesarean sections performed at Cedars Sinai Medical Center, a tertiary referral center with a university affiliation, in calendar year 1992. The records were reviewed and all ICD-9 codes recorded. Clinical indications for cesarean were assigned on the basis of operative notes, with corroboration from physician and nursing notes. Appropriateness of clinical diagnoses and quality of medical record abstraction were not addressed.

First, the ICD-9 system proposed by Anderson and Lomas[1] (and tabulated by Taffel et al.[3]) was applied. In this hierarchy, repeat cesareans are placed into a single category. Primary cesareans are then allocated to one of four diagnosis groups in the following order: breech presentation, dystocia, fetal distress, and other indications. In a separate analysis, the clinical indications for primary cesarean section were obtained from chart review and allocated to categories designed to be comparable to the major ICD-9 diagnosis groups.[7]

Repeat cesareans were subjected to the same ICD-9 and clinical hierarchies as primary cesareans. In addition, we examined the ICD-9 codes and clinical indications of cases assigned to the other indications category and compiled a list of ICD-9 codes to distinguish indicated repeat cesareans from elective procedures[7] (see Table 1).

Correlations between assigned ICD-9 diagnoses and clinical diagnoses were assessed with the kappa statistic. We identified problems arising from the use of ICD-9 codes for both primary and repeat cesarean sections.

Results

During calendar year 1992, 1899 cesarean sections for singleton pregnancies were performed. We reviewed the charts involved with 1885 (99.3%) of these cesareans: 1242 primary cesareans and 643 repeat procedures. The ICD-9 indication and clinical indication categories for primary procedures are shown in Table 2. Of the 1242 procedures, 1027 (82.7%) had concordant diagnoses (kappa = 0.741).

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TABLE 1—Indications for Primary and Repeat Cesarean Sections: An Expanded ICD-9 Hierarchy

Category	Primary Cesarean Section		Repeat Cesarean Section (654.2)	
	Description	ICD-9 code	Description	ICD-9 Code
Breech	Breech	652.2	Breech	652.2
Dystocia	Disproportion	653	Disproportion	653
	Obstructed labor	660	Obstructed labor	660
	Abnormality of forces of labor	661 (except 661.3)	Abnormality of forces of labor	661 (except 661.3)
	Long labor	662	Long labor	662
	Malpresentation[a]	652 (except 652.1, 652.5)	Malpresentation[a]	652 (except 652.1, 652.5)
	Failed induction of labor[a]	659.0 or 659.1	Failed induction of labor[a]	659.0 or 659.1
Fetal distress	Fetal distress	656.3	Fetal distress	656.3
	Cord prolapse[a]	663.0	Cord prolapse[a]	663.0
Other	All other diagnosis codes		Antepartum hemorrhage/placental[a] abruption/placenta previa[a]	641
			Intrauterine growth retardation[a]	656.5
			Macrosomia[a]	656.6
			Genital herpes simplex virus[a]	647.6 and/or 54
			Diabetes mellitus/abnormal glucose tolerance[a]	648.0/648.8
			Hypertensive disorders[a]	642
			Oligohydramnios[a]	658.0
			Chorioamnionitis[a]	658.4
			Fetal central nervous system malformation affecting management[a]	655.0
			Other congenital/acquired anomaly[a]	654.6
			Rupture of uterus[a]	665.0 or 665.1
			Congenital/acquired abnormality of vagina[a]	654.7
			Prior classical cesarean section[a]	No code[b]
			Prior myomectomy involving endometrial cavity[a]	No code[b]
			Prior uterine rupture[a]	No code[b]
			Rhesus (anti-D) isoimmunization[a]	656.1
			Cerebral hemorrhage/occlusion[a]	430, 431, 432, 433, 434
Elective repeat cesarean section	Not applicable		Excludes all above indications[a]	None of above codes

[a]Change from the Anderson and Lomas[1] hierarchy.
[b]Code 654.9 (scarred uterus) may be used in some centers.

Discordance occurred for three principal reasons. First, a malposition code alone, without a qualifying breech code, was used in some of the cases of breech presentation. Second, the hierarchy required that cases with both dystocia and fetal distress codes should be allocated to the dystocia category; in some of these cases the physician identified fetal distress as the primary indication for the procedure. Third, clinical diagnoses could be associated with ICD-9 codes in both the dystocia and other categories. We identified three diagnoses that, although in the other indications category, tended to be associated with ICD-9 dystocia codes: failed induction of labor, malpresentation (excluding breech), and macrosomia. Half of the cases of failed induction of labor had codes for primary or secondary uterine inertia that fell under the dystocia category. The second clinical indication with ICD-9 codes in two distinct categories was malpresentation, which fell under malposition and malpresentation of fetus (652) and malposition of the fetus at onset of labor (660.0) (the latter also appears to encompass malpresentations).[2] Because of the potential that failed induction of labor and malpresentation could be included in both the dystocia and the other indications categories, we elected to include these diagnoses (except for breech) in the dystocia category. The third clinical indication with two codes was macrosomia, which fell under unusually large fetus causing disproportion (653.6) and excessive fetal growth (656.6). Chart review showed that the disproportion code (653.6) was generally used for cases with a failed trial of labor. Cesarean without labor is recognized as a reasonable clinical option

when the estimated fetal weight is 4500 g or more; use of the excessive fetal growth code (656.6) without a dystocia code should identify such cases.

ICD-9 codes and clinical indications for repeat cesareans were treated in a manner similar to that used for primary procedures. There was agreement in diagnostic groups in 548 (85.2%) of cases (kappa = 0.715).

After breech presentation, dystocia, and fetal distress had been excluded, the list of ICD-9 codes corresponding to other clinical indications (Table 1) was applied to the remaining repeat cesareans. There was good discrimination for elective procedures; 211 clinically elective procedures were similarly identified by ICD-9 coding, and 69 cases were categorized as "other" by both the ICD-9 and clinical systems. However, 45 cases with documented clinical indications for surgical delivery did not have any of the "other" ICD-9 diagnosis codes recorded. These included cases of prior classical section, prior uterine rupture, and prior myomectomy involving the endometrial cavity (which do not have specific ICD-9 codes). Conversely, 53 additional cases deemed elective by chart review had ICD-9 diagnostic codes consistent with the other indications category; macrosomia, diabetes, hypertensive disorders, oligohydramnios, and intrauterine growth retardation, although present, were not identified as the specific indications for cesarean.

TABLE 2—Primary Cesarean Sections (n = 1242): ICD-9 Indications in Comparison with Clinical Indications

ICD-9 Indication	Principal Clinical Indication				
	Breech	Dystocia	Fetal Distress	Other	Total
Breech	187[a]	1	1	2	191
Dystocia	17	526[a]	40	40	623
Fetal distress	3	26	175[a]	20	224
Other	3	56	6	139[a]	204
Total	210	609	222	201	1242

[a]Concordance of ICD-9 and clinical indications.

Discussion

The use of ICD-9 codes to categorize indications for cesarean section was first discussed by Anderson and Lomas in 1984.[1] Their mutually exclusive hierarchy included five categories, each taking precedence over all succeeding groups. The hierarchy inherent in Anderson and Lomas' system represented an attempt to convert multiple diagnoses into workable, mutually exclusive categories of indications for cesarean. To date, the hierarchical system proposed by Anderson and Lomas has not been validated. Nonetheless, other investigators have applied the technique to assess reasons for cesarean sections in the United States and other countries.[3-6] We attempted to validate this ICD-9 hierarchy in order to determine how closely it approximated clinical indications for cesarean recorded by physicians and found it to be an effective tool for categorizing indications for primary cesareans.

One of the problems inherent in a hierarchy is that the principal clinical diagnosis can be obscured by other concurrent diagnoses; this accounts for much of the discrepancy between the ICD-9 hierarchy and clinical chart review. In addition, we identified three diagnoses that, although clinically recognized as "other" diagnoses, tended to be associated with dystocia ICD-9 codes: failed induction of labor, malpresentation, and macrosomia. Reallocating failed induction of labor and malpresentation (except breech) to the dystocia category improves the utility of the hierarchy by clustering both diagnoses in the dystocia group rather than separating them into two groups.

In 1984, when Anderson and Lomas published their ICD-9 categories, the occurrence of vaginal births after cesarean sections was not common in North America; thus, repeat cesareans were allocated to a single category. Maintaining the single grouping of all repeat cesareans does not allow for the fact that some are not elective and may occur because of failed trial of labor or other indications. Because of the emerging consensus regarding vaginal birth after cesarean, we believed it important to develop a tool that is applicable to repeat cesareans and allows the investigator to distinguish elective repeat cesareans from indicated procedures. When we classified repeat cesareans using the primary hierarchy and created a list of ICD-9 codes corresponding to other recognized indications for repeat cesareans, we found the hierarchy to be an effective tool for distinguishing elective, and presumably avoidable, cesareans from those performed for clinical indications (Table 1).

We identified three important indications for cesarean that do not have specific ICD-9 codes: prior classical cesarean, prior uterine rupture, and prior myomectomy involving the endometrial cavity. All are contraindications for vaginal birth after cesarean. (The nonspecific ICD-9 code 654.91 [uterine scar] may be used in some centers.) The coding system is also limited in identifying truly elective procedures when other diagnoses such as diabetes or hypertension are present. A separate ICD-9 code for elective cesarean section, perhaps with subdivisions for those cases in which the patient refused an offered trial of labor, would be helpful in the future.

We recognize that ICD-9 assignments made by medical records technicians are subject to human error and that all possible diagnoses may not be recorded or abstracted. This could lead to inappropriate assignments for the procedure. While the revised Anderson and Lomas hierarchy appears to be a useful tool, the reliability of chart recording of diagnoses and of medical record technician abstraction may vary among institutions, which would affect generalizability to other facilities.

Trial of labor after a prior cesarean is encouraged by clinicians, consumer groups, and public health analysts. Payers and quality assurance entities are becoming increasingly interested in cesarean and vaginal birth after cesarean rates as measures of both the quality and appropriateness of care. It is imperative that systems of analysis for aggregate data represent the clinical decision-making process as closely as possible. Our study suggests that application of this revised hierarchy to aggregate data yields results that approach the clinical decisions leading to cesarean. Furthermore, and perhaps more important from a health policy perspective, application of discrete codes to the other indications category allows clinically indicated repeat cesareans to be reasonably differentiated from potentially avoidable elective operations. □

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The Epidemiology of Vulvovaginal Candidiasis among University Students

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ABSTRACT

Vulvovaginal candidiasis affects approximately 20% of women annually, but it is not well characterized epidemiologically. Of 1027 respondents to two mailed cross-sectional surveys at a large university, 37.5% reported a prior clinical diagnosis of vulvovaginal candidiasis. The frequency of first diagnosis increased rapidly after age 17, with an estimated 54.7% of women experiencing the condition by age 25. In a proportional hazards model of age at first diagnosis, vulvovaginal candidiasis was associated with initiation of sexual activity (rate ratio [RR] = 2.9; 95% confidence interval [CI] = 2.2, 3.8), oral contraceptive use (RR = 1.7; CI = 1.4, 2.2), and White (RR = 3.1; CI = 1.7, 5.7) and Black (RR = 5.9; CI = 3.0, 11.5) race vs Asian. (*Am J Public Health.* 1995;85: 1146–1148)

Introduction

Vulvovaginal candidiasis is an inflammatory condition caused by yeast, predominately *Candida albicans.* This condition results in severe genital itching, vaginal odor, and abnormal discharge. Self-reported history of vulvovaginal candidiasis ranges from 20% among students[1] to 45% of a general population sample[2] to 72% of family practice clinic users.[3] Widely available vaginal antifungals cure the condition, but some 15% to 20% of women experience a second infection within 1 to 3 months.[4,5] An estimated $600 million per year is spent on the diagnosis and treatment of vulvovaginal candidiasis among women aged 15 to 45 years.[6]

Investigation of possible risk factors for vulvovaginal candidiasis should lead to an increased understanding of its pathogenesis, resulting in an improved ability to treat and prevent it. To date, oral contraceptives, sexual activity, antimicrobial use, and many other possible risk factors have been associated with vulvovaginal candidiasis in anecdotal reports and occasionally in clinic-based studies, but none of these associations has been conclusive.[5,6]

To determine the age distribution of first onset in young women and to examine possible associations of this condition with sexual activity, contraceptive practices, and demographic characteristics, we conducted two mailed cross-sectional surveys of students at a large university. This is the first population-based study to address the age distribution of first onset and one of the few to examine possible risk factors for vulvovaginal candidiasis.

Methods

Survey recipients were randomly selected from all female students registered at the University of Michigan in the fall terms of 1992 and 1993, stratified by year in school (four undergraduate years plus graduate students). Of those selected, 952 of 1000 in 1992 and 979 of 1050 in 1993 had correct local addresses, with 603 (63.3%) responding in 1992 and 458 (46.8%) in 1993. Graduate students were slightly more likely to respond than undergraduates. Of the 1061 respondents, 34 had data missing for multiple variables and were excluded, leaving a final sample size of 1027. All survey recipients received an explanatory letter, a return envelope, a small incentive, and an anonymous questionnaire asking about their history of clinically diagnosed vulvovaginal candidiasis, demographic characteristics, past sexual activities, and use of various contraceptives. The University of Michigan School of Public Health Human Subjects Review Committee approved both studies.

The Kaplan-Meier method,[7] along with 95% Hall-Wellner confidence bands,[8]

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