ABSTRACT

A retrospective study of neural tube defects (NTDs) was carried out among elective terminations of pregnancies, stillbirths and live births to women residing in two regions of Quebec, in 1992. Primary data sources included the hospital administrative data system MEDECHO, stillborn and infant death certificates, and the list of patients seen at three spina bifida clinics. Hospital records were reviewed. A total of 30 NTD cases were identified. The prevalence rate was 1.41 per 1,000, indicating a three-fold reduction in frequency during the last three decades. All 17 cranial defects but only 5 of 13 spinal defects were diagnosed during pregnancy. Elective terminations were performed at an average gestation of 18 weeks (range 11 to 21 weeks). The MEDECHO file allows a complete identification of NTD cases, but diagnostic categories are not very specific and coding errors are present.

ABRÉGÉ

Une étude rétrospective des anomalies de fermeture du tube neural (AFTN) a été réalisée parmi les interruptions médicales de grossesse, les mortinaissances et les naissances vivantes de mères résidant dans deux régions du Québec, en 1992. Les sources d'information primaires ont été le système médico-administratif MEDECHO, les certificats de mortinaissances et de décès infantiles, ainsi que la liste de patients suivis dans trois cliniques de spina bifida. Les dossiers hospitaliers ont été consultés. Au total, 30 cas d'AFTN ont été identifiés. Le taux de prévalence est de 1,41 pour mille, ce qui indique une réduction par un facteur 3 durant les trois dernières décennies. Les 17 cas de malformation crânienne ont été détectés en début de grossesse, mais seulement 5 des 13 cas de malformation de la colonne vertébrale. Les interruptions de grossesse ont été pratiquées en moyenne à 18 semaines de gestation (valeurs extrêmes : 11 et 21 semaines). Le fichier MEDECHO permet une identification complète des cas d'AFTN, mais les catégories diagnostiques sont peu spécifiques et il existe des erreurs de codification.

Prevalence of Neural Tube Defects in the Province of Quebec, 1992

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Neural tube defects (NTDs) constitute an important public health problem in terms of mortality, morbidity, social cost and human suffering.¹ It is well established that increasing consumption of food folate or using folic acid supplements during the periconceptional period decreases the risk of affected pregnancy.²⁻⁸ In 1993, the Society of Obstetricians and Gynaecologists of Canada recommended that all women of childbearing potential should consider 0.4 mg folic acid supplementation or adequate dietary equivalent on a daily basis.⁹ In 1994, the Canadian Task Force on the Periodic Health Examination also recommended that women of childbearing age increase their consumption of folic acid to 0.4 mg/d.¹⁰ In the U.S., fortification of grain and cereal products at a level of 140 mg of folic acid /100 g of grain is mandatory, effective January 1st, 1998.¹¹ Fortification at the same level is authorized in Canada. In Quebec, there is no systematic program for prenatal detection of NTDs using measurement of maternal serum α -fetoprotein level. Screening in low risk pregnancies relies on ultrasonographic examination, which is usually offered between 16 and 20 weeks of gestation.¹² The effectiveness of

these prevention strategies should be evaluated.

We performed a retrospective study in two regions of the province of Quebec, namely the Eastern Townships and Montérégie, in order to assess the prevalence of NTDs at birth, and to evaluate the impact of prenatal diagnosis and selective termination of affected pregnancies. We also wanted to estimate the validity of hospital discharge summary data currently used for epidemiologic surveillance in Canada.¹³

METHODS

The study population includes elective terminations for fetal malformations, stillbirths and live births, occurring in 1992, to women residing in the regions of the Eastern Townships and Montérégie (representing approximately 20% of the total population of the province of Quebec). The primary data source was MEDECHO, the province-wide hospital administrative data system. For each discharge from acute-care hospitals, a summary of the causes of hospitalization, diagnoses, medical and surgical interventions, and outcome is written by the physician in charge of the case. Medical archivists code the main diagnosis and up to 15 secondary diagnoses, using the 9th revision of the International Classification of Diseases (ICD).¹⁴ The entire database was searched for two categories of patients: infants less than one year of age with a code indicating a congenital malformation of the central nervous system (ICD 740.0 to 742.9, including anencephalus ICD 740, spina bifida ICD 741, and encephalocele ICD 742.0), and women with an ICD code indicating a known or suspected fetal

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abnormality (ICD 655), including central nervous system malformation in the fetus (ICD 655.0). The list of stillbirths and infant deaths for any cause was obtained from the Quebec statistics office. The lists of patients seen at three spina bifida clinics in the study region (Centre Universitaire de Santé de l'Estrie) and Montreal (Sainte-Justine and Montreal Children's Hospital) were also available.

Records of infants and mothers were linked and duplicate infant records were found using an automated routine based on health insurance number, hospital number, medical file number, and date of birth. The validity of record linkage was verified manually using other variables such as maternal age, sex of the child, birthweight, gestational age and place of residence. Access to medical records was requested and maternal and/or child records were reviewed in 17 hospitals.

Prevalence rates were expressed as the total number of cases, including elective terminations, divided by the total number of live births and stillbirths. Confidence intervals of rates were calculated on the basis of a Poisson distribution as described by Scherrer.¹⁵ Prevalence rates were compared using a Chi-square test. The study protocol was approved by the Quebec Commission for Access to Information and by the Ethics Committee of the "Centre Universitaire de Santé de l'Estrie".

RESULTS

In 1992, 80 stillbirths and 21,174 live births were registered in the regions of the Eastern Townships and Montérégie. There were 107 MEDECHO records of 61 infants with a code of congenital malformation of the central nervous system, including 17 records of 10 infants with a code specific for NTDs. In the latter group, three infants had incorrect coding, including one case of hydranencephaly coded as anencephaly, and two other cases in which a myelomeningocele was suspected but the diagnosis not confirmed. An unusual case with a code of spina bifida (ICD 741.9) was considered as neural tube defect: the infant had a cleft of the conus medullaris and agenesis of the posterior arch of the 4th and 5th lumbar vertebrae,

which required surgery. One additional infant had diastematomyelia with spina bifida that was coded as "other specified anomaly of the spinal cord" (ICD 742.5). A total of 8 true NTD cases were thus identified in live births. There were 33 MEDECHO records of 27 women with a code indicating a central nervous system malformation in the fetus. In this group, 22 cases of elective termination for NTD were identified.

No further NTD cases were found either by review of stillbirth or infant death certificates or by review of the list of patients seen at three spina bifida clinics in Sherbrooke and Montreal. Overall, the sensitivity of the NTD-specific categories (ICD 740, 741 and 742.0) for identifying NTD cases in live births was 7/8, while the positive predictive value was 7/10.

The prevalence rate of all NTDs was 1.41/1,000 births (95% confidence interval: 0.95/1,000 - 2.01/1,000). The distribution of the different categories of NTDs is indicated in Table I. Among encephaloceles, the cranial defect was parietal in 3 cases, occipital in 2 other cases, and the site was not specified in the remaining 2 cases. Among myelomeningoceles, the site of the defect was dorsal in 3 cases, lumbar in 6 cases, sacral in one case, and unspecified in the last case. The defect was thoracic in the first diastematomyelia case and lumbosacral in the second. Twenty-two of the 30 NTD cases (73%) were detected antenatally by echography and elective terminations were performed at an average gestation of 18 weeks (range 11 to 21 weeks). All the 17 cranial defects but only 5 of the 13 spinal defects were diagnosed during pregnancy.

DISCUSSION

In the present study, several sources were used to ensure a complete identification of NTD cases: the hospital administrative data system MEDECHO, stillborn and infant death certificates, and the list of patients seen at three spina bifida clinics. In 1992, terminations of pregnancies for fetal abnormality were normally performed in hospitals and a MEDECHO record was completed for all day-care and in-patients. Underascertainment of induced abortions

is thus unlikely. In another study covering the period 1961-1965, several sources were also used and results can be compared: 1) review of medical records of all stillbirths and neonatal deaths in all hospitals with maternity units or pediatric department, 2) medical records of all patients with spina bifida recorded in hospitals with maternity units or pediatric department, 3) hospital insurance claim forms for all patients with spina bifida recorded by the Ministry of Health, and 4) stillbirth and death certificates in which death was attributed to anencephaly or spina bifida.¹⁶ At that time, prenatal diagnosis did not exist. In a more recent study in Eastern Ontario and Western Quebec,¹⁷ district hospitals were invited to provide names of families with NTD birth during the years 1969-1981. Secondary sources included records of a tertiary level hospital and the Spina Bifida Association. Under-reporting of anencephaly cases is suggested by the very low anencephaly/spina bifida ratio (122/255).

In Eastern Townships and Montérégie areas, the combined prevalence of anencephaly and myelomeningocele decreased from 3.5/1,000 in 1961-1965¹⁶ to 0.96/1,000 in 1992 ($p < 0.001$). This is not explained by difference in ascertainment or the effect of selective terminations following prenatal diagnosis. In Europe, a similar trend was observed in high prevalence areas in the British Isles, but not in continental low prevalence areas.¹⁸ In the U.S.¹⁹ and Canada,²⁰ changes are difficult to interpret because the existing information systems do not adequately register terminations of pregnancy for fetal malformations. There may be several causes for the decline in NTD prevalence in pregnancies in Quebec. Obviously, changes occurred in dietary habits, but there are no good data on the evolution of folate intake. Also, an increasing proportion of people are regularly consuming nutritional supplements. In a survey in 1990, 15% of women aged 18 to 34 years declared having taken supplements containing folic acid during the previous month.²¹ More studies are needed to evaluate the impact of the folic acid fortification policy introduced in 1998 and of educational programs promoting the use of vitamin supplements by women of child-bearing age.

TABLE I
Prevalence of Neural Tube Defects in the Regions of the Eastern Townships and Montérégie, Province of Quebec, 1992

	Termination of Pregnancy	Live Birth	Total	Rate/1,000 Births
Anencephaly	10	-	10	0.47
Encephalocele	7	-	7	0.33
Myelomeningocele	5	5	10	0.47
Diastatomyelia	-	2	2	0.09
Cleft conus medullaris	-	1	1	0.05
All neural tube defects	22	8	30	1.41

Primary prevention is the ideal solution to the problem of NTDs. However, prenatal detection and selective termination of affected pregnancies will remain an option because a substantial proportion of NTDs is not preventable even by large doses of folic acid.⁵ The present study indicates that routine ultrasonographic examination is highly effective in detecting anencephaly and large encephalocele, which are usually lethal. Myelomeningocele and other spinal defects seem to be frequently missed. In this study, ultrasonographic examinations could not be systematically reviewed because the hospital record of the mother was not always available, and because the results of prenatal examinations are often kept in private clinics.

The Canadian Congenital Anomalies Surveillance System relies mainly on hospital admission/discharge summary databases, one of which is MEDECHO.^{13,20} Although numbers are small, there is a clear indication of the low validity of these data in Quebec. A first problem is the lack of specificity of the coding system, using the four-digit categories of the International Classification of Diseases.¹⁴ NTD cases were found in non-specific categories such as "women with known or suspected central nervous system malformation in the fetus" (ICD 655.0) or "other specified anomaly of the spinal cord" (ICD 742.5). A second problem is inherent in the way clerks are instructed to record any diagnosis, either suspected or confirmed, on the discharge summary, leading to false positive identifications. Poor sensitivity and predictive value in recording birth

defects have also been observed in hospital discharge data sets in the U.S.²¹⁻²⁴ This source of information should be used with great care.

In conclusion, it appears that the prevalence of NTDs in two regions of Quebec has been reduced by a factor of 3 during the last three decades. Currently, three quarters of NTD cases are detected antenatally by routine ultrasonography and pregnancies terminated. The impact of food fortification and educational programs promoting the use of vitamin supplements remains to be seen. Hospital summary files constitute a very useful source of information for initiating studies on NTDs, but verification of diagnoses in the original medical record is a must.

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