

# Folic acid supplements during pregnancy and risk of miscarriage

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## Summary

**Background** Although taking supplements that contain 400 µg of folic acid before and during early pregnancy reduces a woman's risk for having a baby with a neural-tube defect (NTD), the effects of such supplements on other pregnancy outcomes remain unclear. We examined whether the use of such supplements affects the occurrence of miscarriage.

**Methods** Participants were women in China who had taken part in a recent folic acid campaign to prevent NTDs and who had registered in this campaign before they became pregnant for the first time. We examined the risk for miscarriage among women who had confirmed pregnancies and who had or had not taken pills containing only 400 µg of folic acid before and during early pregnancy.

**Results** The overall rate of miscarriage was 9.1% (2155/23 806). The rates of miscarriage among women who had and had not taken folic acid pills before and during the first trimester were 9.0% and 9.3%, respectively (risk ratio 0.97 [95% CI 0.84–1.12]). The distributions of gestational age at pregnancy diagnosis and at miscarriage were similar for both groups of women.

**Interpretation** In this population-based study of a cohort of women whose use of folic acid supplements while pregnant had been previously documented and who had been pregnant for the first time, we found no evidence that daily consumption of 400 µg of folic acid before and during early pregnancy influenced their risk for miscarriage.

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## Introduction

Periconceptional consumption of folic acid supplements, alone or in combination with other vitamins, reduces a woman's risk for having a child with a neural tube defect (NTD).<sup>1,2,3</sup> Despite this well-documented benefit of folic acid consumption, in 1997 a study that examined pregnancy outcomes among women who participated in randomised controlled trials to prevent NTDs<sup>1,2</sup> reported a 16% increased risk for miscarriage among women who had taken a multivitamin containing 800 µg of folic acid.<sup>4</sup> This study highlights the need for additional assessments of the impact of folic acid supplements on the risk of miscarriage.

Opportunities for studying the relation between folic acid supplements and risk for miscarriage have been limited because such an assessment requires a large group of childbearing-aged women whose consumption of folic acid from supplements is known. Ideally, women should be identified before or very early in pregnancy and monitored prospectively for pregnancy outcomes, including miscarriages. Such study populations are not readily available. However, a recent public health campaign in China that used a pill containing 400 µg of folic acid alone to prevent NTDs provided just such an opportunity to study the effects of folic acid consumption before and during early pregnancy on the occurrence of miscarriage.

## Methods

### *Background and source of cohort*

Beginning in 1993, the Chinese Ministry of Health did a public health campaign to prevent NTDs among all women in 21 counties in three provinces who were preparing for marriage or planning to become pregnant.<sup>3</sup> During this campaign, all women residents of the project counties who registered for marriage or who became pregnant were registered in a pregnancy monitoring programme. All women were asked to take a pill containing 400 µg of folic acid and no other vitamins or minerals every day starting as soon as possible after registration and continuing until completion of the first trimester of pregnancy.

Each month during the campaign, local health workers collected information about each woman's pill-taking, including the number of pills taken, dates of starting and stopping pills, and the dates of every menstrual period. Health workers visited each woman to collect the previous month's folic acid pill bottle and to give each woman a new bottle; each bottle, designed for one month's use, contained 31 pills. Health workers counted pills, filled out a form for each woman, and sent this information to the campaign evaluation headquarters (Peking University Health Sciences Center [PUHSC]), where it was analysed and stored. All women were advised to have a pregnancy test 1 to 2 weeks after a missed menstrual period or if they believed they were pregnant. Health workers used a urine pregnancy test that determined the presence of human chorionic gonadotropin (hCG), using colloidal gold-labelled anti-hCG coated on a nitrocellulose strip.<sup>5</sup> For every pregnancy, each woman had a booklet with data on past

\*Other participants in the Jiaxing City Collaborative Project on Neural Tube Defect Prevention are listed at the end of the paper

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pregnancy history, the prenatal period, and delivery. After the end of pregnancy these data were sent to campaign headquarters for use in the assessment. This booklet was the source of demographic data, date of last menstrual period, and dates and outcome of pregnancy used in the NTD assessment. Although the campaign included information on all pregnancies, the report on the assessment of the use of folic acid to prevent NTDs did not include pregnancies of less than 20 gestational weeks because the presence or absence of an NTD could not be confirmed in those cases.

#### Study population

We identified all women who resided in Jiaxing City (an administrative area in Zhejiang Province), who had a premarital examination during the public health campaign, and who were pregnant for the first time. To ensure that all women had had the same opportunity to take folic acid, we included all women who had completed a premarital examination from Oct 1, 1993 (when folic acid supplements were first offered), through to Sept 30, 1995 (when the last women who had complete pill-taking records were registered). Because women who registered after becoming pregnant may have had an unrecognised miscarriage before they had registered, we excluded all women who registered after the first day of their last menses.

During the campaign, local health workers maintained additional records (which were not sent to campaign headquarters) of the dates of all menses and dates and results of any pregnancy tests for each woman. We asked these local health workers to provide additional information (dates of the first day of the last menstrual period, dates and results of pregnancy tests, and dates and results of every pregnancy) for all women, including those who had clinically recognised miscarriages at less than 20 weeks' gestation. We were thus able to assess the potential effect of these women's well-documented daily use of 400 µg of folic acid supplements on the occurrence of miscarriage.

This project was approved by the institutional review boards of the Centers for Disease Control and Prevention (CDC) and the PUHSC, China.

#### Definitions

We defined a miscarriage as any report of a spontaneous fetal death, following a positive pregnancy test that occurred until a gestational age of 20 weeks. We excluded 115 women (0.5%) who had an induced abortion.

We used records from the campaign to classify women as those who had or had not taken folic acid before or during their first pregnancy. We divided women who had taken folic acid pills into two patterns of use groups depending upon when they started taking pills relative to the first day of their last menstrual period, and the duration of periconceptional pill-taking comprised women who began taking pills at any time before becoming pregnant and who continued taking pills until the end of the first trimester (or, in the event of a miscarriage before the end of the first trimester, until the date of miscarriage); and other use of folic acid comprised all other women who took pills before or during early pregnancy, including women who either stopped taking pills before they became pregnant or stopped before the end of the first trimester or who started taking pills after the first day of their last menses. We defined women who had no use of folic acid as those who never took pills before or during their first pregnancy.

For each woman who took folic acid, we used pill counts from the monthly pill-taking records to compute pill-taking compliance for the 5 months surrounding the date of conception, which we estimated by adding 2 weeks to the first day of the last menses. We included the month preceding conception, the month during which conception occurred, and the 3 months after conception. We calculated percentage compliance by dividing the number of pills taken by the total number of days that pills could have been taken during this 5-month period.

#### Statistical analysis

We compared the numbers of women who had or had not taken folic acid according to their age at the date of their last menses, body-mass index, ethnicity, education, and occupation. For all women, we calculated gestational ages using the first day of the last menses, and compared the means and distributions of gestational age at the time of diagnosis of pregnancy and at the time of miscarriage, using *t* test to compare means, and the Kolmogorov-Smirnov test to compare distributions.

We determined the rate and 95% CI for miscarriages among women with periconceptional and other folic acid use, and women who had not taken folic acid. We calculated risk ratios by dividing the risk for miscarriage among women who had taken folic acid by the risk among those who had not taken folic acid, adjusting for education and occupation using stratified analysis. For all risk ratios, we calculated 95% CIs according to the Mantel-Haenszel test.

## Results

More than 95% of newly married women became pregnant during the study period. Of the 23 806 women who were pregnant for the first time, 92% had taken folic acid pills at some time before becoming pregnant or during early pregnancy (table 1). Almost all women were 20–29 years old, and more than 90% were 22–27 years old. Women who took folic acid were slightly younger (mean difference 4 months,  $p < 0.0001$ ). Compared with women who had not taken folic acid, a significantly greater proportion of women who had taken folic acid

	Any use of folic acid pills* (n=21 935)	No use of folic acid pills† (n=1871)	p
<b>Age at pregnancy (years, mean [SD])</b>	23.5 (1.5)	23.8 (2.1)	<0.0001
<b>Body mass index (kg/m<sup>2</sup>, mean [SD])</b>	20.4 (2.2)	20.5 (2.2)	0.20
<b>Han ethnic group</b>	21 692 (98.9%)	1820 (97.3%)	0.26
<b>Level of education</b>			<0.0001
High school or college	1158 (5.3%)	214 (11.4%)	
Junior high school	12 858 (58.6%)	1087 (58.1%)	
Elementary school or none	7750 (35.3%)	529 (28.3%)	
Unknown	169 (0.8%)	41 (2.2%)	
<b>Occupation</b>			<0.0001
Farmer	12 196 (55.6%)	1016 (54.8%)	
Factory worker	9038 (41.2%)	672 (35.9%)	
Other	534 (2.4%)	142 (7.6%)	
Unknown	167 (0.8%)	41 (2.2%)	

\*Any use of folic acid pills includes any woman who had taken pills before or during her first clinically recognised pregnancy. †No use of folic acid pills includes 21 women who indicated they intended to take pills but who had taken no pills; and 12 women who started to take folic acid pills after the end of their first pregnancy.

Table 1: Characteristics of women who enrolled in the pregnancy monitoring system before becoming pregnant for the first time according to their use of folic acid pills

Characteristics	Median pill-taking compliance	Completed first trimester
<b>Education</b>		
High school or college	98%	67%
Junior high school	98%	71%
Elementary or none	98%	70%
<b>Occupation</b>		
Farmer	98%	73%
Factory worker	98%	68%
Other	98%	64%

Table 2: Median pill-taking compliance and taking pills through first trimester of pregnancy among women who took folic acid by education and occupation

had not attended high school or college, and were farmers or factory workers. However, in all other demographic and anthropometric characteristics, both groups were similar.

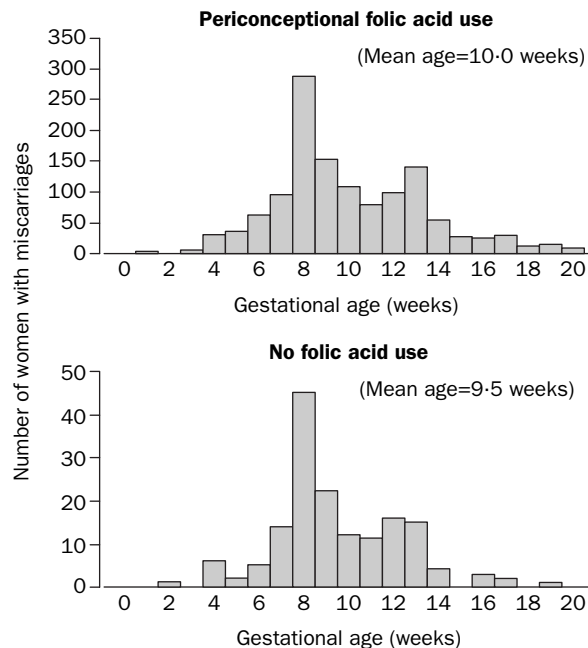
Table 2 shows the median percentage compliance with daily pill-taking and the percentage of women who completed the recommended course (ie, took folic acid until the end of the first trimester of pregnancy) by educational and occupational strata. Daily compliance with and completion of the course of pill taking were high and showed little variation between these strata.

Overall, 2155 (9.1%) women had a miscarriage (table 3). The rates of miscarriage were similar for women with no folic acid use and for those with any pattern of folic acid use. Compared with women who had no folic acid use, the risk ratio of miscarriage for women with any folic acid use was 0.97 (95% CI 0.84–1.12). For women with periconceptional folic acid use, the risk ratio was 1.03 (95% CI 0.89–1.20) and for women with other use was 0.87 (95% CI 0.74–1.02). These results did not change when we adjusted for differences in education and occupation.

Gestational age at miscarriage among women with periconceptional folic acid use and those with no folic acid use did not differ appreciably (mean 73 days and 70 days, respectively;  $p=0.07$ ; distribution:  $p=0.24$ ). The figure shows gestational age at miscarriage in weeks. Gestational age at the time of a positive pregnancy test was available for 67% and 54% of women with periconceptional folic acid use and with no use, respectively. The mean gestational age at pregnancy diagnosis was 58 days for women who used folic acid and 62 days for women who did not use folic acid ( $p=0.004$ ).

## Discussion

In this population-based retrospective study of a cohort of young women having their first pregnancy, the overall rate of miscarriage was 9.1%. We found no evidence of an increased or decreased risk for miscarriage among women who had and had not taken folic acid supplements before and throughout early pregnancy. We found similar gestational ages for the diagnosis of



Gestational age at miscarriage by folic acid pill taking status, Jiaying City, China, 1993–98

Data on gestational age at miscarriage available for 1262 (98%) of women with periconceptional use of folic acid and 159 (91%) of women with no use of folic acid.

pregnancy and for the occurrence of miscarriages between both groups of women.

The overall miscarriage rate in this cohort of women having their first pregnancy is similar to that reported in the only other population-based study, which was done on the island of Kauai,<sup>6</sup> but lower than that reported in some cross-sectional studies. For example, in a study of early pregnancy loss, Wilcox and colleagues<sup>7</sup> reported an 11.6% loss of clinically recognised pregnancies. However, in Wilcox's study the women had a wider range of maternal age, with 28% of mothers older than 30 years of age, and a greater proportion of women in that study had been pregnant at least once before enrolment (including 11% with at least one previous recognised miscarriage).

Published reports on the relation between folic acid supplementation during pregnancy and risk for miscarriage have been inconsistent. Several studies have reported that defects in folic acid and homocysteine metabolism,<sup>8–11</sup> folic acid antagonists,<sup>12</sup> and folic acid deficiency<sup>13,14</sup> are associated with an increased risk for pregnancy loss. By contrast with these studies, others have suggested that folic acid supplementation during pregnancy may be associated with an increased risk for miscarriage.<sup>4,15</sup> In 1997, Hook and Czeizel<sup>4</sup> analysed data from randomised trials and reported that folic acid was

Use of folic acid pills during pregnancy	Pregnant women (n=23 806)	Pregnant women who miscarried (n=2155)	Rate of miscarriages/100 clinically recognised pregnancies (95% CI)	Risk ratio (95% CI)		
				Crude	Adjusted for education	Adjusted for occupation
None*	1871	174	9.3 (8.0–10.7)	..	..	..
Any	21 935	1 981	9.0 (8.7–9.4)	0.97 (0.84–1.12)	0.97 (0.84–1.12)	0.98 (0.83–1.15)
Periconceptional†	13 494	1 295	9.6 (9.1–10.1)	1.03 (0.89–1.20)	1.03 (0.89–1.20)	1.05 (0.89–1.24)
Other‡	8311	671	8.1 (7.5–8.7)	0.87 (0.74–1.02)	0.87 (0.74–1.02)	0.87 (0.73–1.04)

\*Reference group. †Use of folic acid pills starting before the first day of the last menstrual period and continuing through the end of the first trimester, or, in the event of a miscarriage before the end of the first trimester, until the time of miscarriage. ‡Any other folic acid use before or during the first trimester of the first pregnancy.

†and ‡130 pregnant women (including 15 who miscarried) had missing dates for LMP and could not be sub-classified.

Table 3: Rates of miscarriages and crude and adjusted risks of miscarriage among women pregnant for the first time in Jiaying city, according to the use of folic acid pills during pregnancy\*

associated with a significant 16% increase in miscarriage among women in the Hungarian trial<sup>2</sup> who consumed a multivitamin supplement containing 800 µg of folic acid, compared with women who received only trace vitamins and minerals. In addition, they analysed data from the Medical Research Council (MRC) randomised study in the UK; by including all women who were randomly assigned treatment, they found a non-significant 15% increase in miscarriage associated with the use of 4000 µg of folic acid.<sup>1</sup> The MRC responded with their own analysis of miscarriages only including women who became pregnant, and showed a smaller increase of 6%, which also was not statistically significant.<sup>16</sup> One hypothesis suggested to explain this observation is that folic acid may extend the viability of fetuses that might otherwise be lost so early as to be unrecognised as miscarriages. More recently, Windham and co-workers<sup>15</sup> reported a non-significant increased occurrence of miscarriage among women interviewed during the first trimester who reported having taken multivitamins or folic acid during the prenatal period (risk ratio 1.14, 95% CI 0.96–1.35). Despite the limitation in both these studies that women had taken pills containing other vitamins as well as folic acid (making it impossible to attribute any observed effect to folic acid alone), both investigators chose to associate only folic acid with the purported increase in miscarriages.

Our study found no difference in the rates of miscarriage between women who had taken folic acid pills before or during pregnancy and women who had not taken folic acid. The study was population-based and included large numbers of women who had taken folic acid supplements, and more women who miscarried than has been reported in other studies. Even with these numbers, we had limited statistical power (52%, at  $\alpha=0.05$ ) to detect an increase of 16% over the unexposed miscarriage rate of 9.3%. However, the rate of miscarriage in periconceptional users (rate 9.6% [95% CI 9.1–10.1]) is based on a large number of women with well-documented, highly compliant use of folic acid<sup>3</sup> and gives us a good estimate of the rate of miscarriage among women who took folic acid. This miscarriage rate is actually lower than that reported for women in the general population who did not use folic acid in other studies of pregnancies.<sup>4,16</sup>

Because we had accurate gestational ages, we were able to examine the possibility that pregnancies or miscarriages were identified differently in the two groups of women. We found no evidence of a shift in the distribution of gestational age at miscarriage for women who had and had not taken folic acid pills (figure), and thus no support for the hypotheses that folic acid may extend the viability of fetuses that might otherwise be lost as unrecognised early fetal losses or that folic acid may selectively induce miscarriage in fetuses with an NTD.<sup>17,18</sup>

We considered the possibility that the lack of an effect from folic acid in our study may have been due to differences between women who did and did not take folic acid. The difference in maternal age is too small to impact the results. Although we did not have data on alcohol and tobacco use, drinking alcohol and smoking cigarettes are uncommon behaviours among rural Chinese women. All of the women in our study had a premarital examination and registered before becoming pregnant. Typically, these women attempt to become pregnant as quickly as possible; more than 80% became pregnant within 12 months of registration. As shown in table 1 these women are very similar in almost all respects. Education and occupation appear similar, but

the small differences are statistically significant. However, table 2 shows little difference in pill use among these women. Adjustment for education and occupation has virtually no impact on the risk ratios and 95% CI as shown in table 3.

One limitation of this study is that the pregnancy test used was not sensitive enough to detect hCG before the first missed menses; therefore, we were not able to assess clinically unrecognised miscarriages, but we could assess whether clinically recognised pregnancies were diagnosed at similar gestational ages. The means of gestational age at pregnancy diagnosis were significantly different between women with periconceptional use and women with no use of folic acid pills, respectively. This small difference (4 days) is unlikely to have clinical significance and the statistical significance of this difference is probably due to the large numbers of women in our study. It is doubtful that either group was more likely than the other to include clinically unrecognised pregnancies, and, presumably, clinically unrecognised miscarriages. In addition, because we noted no significant differences in gestational age at miscarriage it is unlikely that miscarriages were ascertained differentially between women who had periconceptional use of folic acid and women who had no use.

Our study had many strengths. We had nearly complete ascertainment of all pregnancies during a 2-year period among women living in one administrative area. By limiting the study population to women who were pregnant for the first time, we avoided potential confounding by previous miscarriages. Because women had taken tablets containing 400 µg of folic acid alone, we were able to study the effect of folic acid unconfounded by other nutrients contained in multivitamin supplements. Because pill-taking data were collected prospectively, before the outcome was known, we avoided the potential for recall bias. By studying a group women who had begun taking folic acid pills on or before their last menses, and who continued for about 14 weeks after their last menses, we could observe the effect of folic acid on pregnancy outcome in women who had almost continuous exposure to 400 µg of folic acid daily for the entire time during which most clinically recognised miscarriages occurred.

These findings do not support concerns about an increased risk for miscarriages associated with consumption of folic acid during pregnancy.

#### Contributors

J David Erickson initiated the study; R J Berry and Zhu Li designed the study and R J Berry and Adolfo Correa supervised all aspects of the analysis. Jacqueline Gindler and Jun-chi Zheng did the epidemiologic analysis, and Lee-Yang Wong did the statistical analysis. Xia-mei Sun, Ling-chun Cheng, and Qiao-ling Tong supervised all aspects of fieldwork, and Yu Wang was responsible for the design of the data collection instruments, computer programming, and data management.

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## References

- 1 MRC Vitamin Study Research Group. Prevention of neural tube defects: results of the medical research council vitamin study. *Lancet* 1991; **338**: 131–37.
- 2 Czeizel AE, Dudás I. Prevention of the first occurrence of neural tube defects by periconceptional vitamin supplementation. *N Engl J Med* 1992; **327**: 1832–35.
- 3 Berry RJ, Li Z, Erickson JD, et al. Preventing neural-tube defects with folic acid in China. *N Engl J Med* 1999; **341**: 1485–90.
- 4 Hook EB, Czeizel AE. Can terathanasia explain the protective effect of folic-acid supplementation on birth defects? *Lancet* 1997; **350**: 513–15.
- 5 Xu Z. [Immunogold dot assay for diagnosis of early pregnancy] Chinese. *Chung Hua Hsueh Tsa Chih (Taipei)* 1992; **72**: 216–18.
- 6 French FE, Bierman JM. Probabilities of fetal mortality. *Public Health Rep* 1962; **77**: 835–47.
- 7 Wilcox AJ, Weinberg CR, O'Connor JF, et al. Incidence of early loss of pregnancy. *N Engl J Med* 1988; **319**: 189–94.
- 8 Ou CY, Stevenson RE, Brown VK, et al. 5,10 Methylene tetrahydrofolate reductase genetic polymorphism as a risk factor for neural tube defects. *Am J Med Genet* 1996; **63**: 610–14.
- 9 van der Put NM, Steegers-Theunissen RP, Frosst P, et al. Mutated methylenetetrahydrofolate reductase as a risk factor for spina bifida. *Lancet* 1995; **346**: 1070–71.
- 10 Christensen B, Arbour L, Tran P, et al. Genetic polymorphisms in methylenetetrahydrofolate reductase and methionine synthase, folate levels in red blood cells, and the risk of neural tube defects. *Am J Med Genet* 1999; **84**: 151–57.
- 11 Botto LD, Mastroiacovo P. Exploring gene-gene interactions in the etiology of neural tube defects. *Clin Genet* 1998; **53**: 456–59.
- 12 Thiersh JB. Therapeutic abortions with folic acid antagonists, 4 amino pteroylglutamic acid administered by the oral route. *Am J Obstet Gynecol* 1952; **63**: 1298–304.
- 13 Bendich A. Importance of vitamin status to pregnancy outcomes. In: Bendich A, Butterworth CE, eds. *Micronutrients in health and in disease prevention*, New York: Marcel Dekker, 1991; 251.
- 14 Ray JG, Laskin CA. Folic acid and homocyst(e)ine metabolic defects and the risk of placental abruption, pre-eclampsia and spontaneous pregnancy loss: a systematic review. *Placenta* 1999; **20**: 519–29.
- 15 Windham GC, Shaw GM, Todoroff K, Swan SH. Miscarriage and use of multi-vitamins or folic acid. *Am J Med Genet* 2000; **90**: 261–62.
- 16 Wald N, Hackshaw A. Folic acid and prevention of neural-tube defects. *Lancet* 1997; **350**: 665.
- 17 Hook EB. Folic acid and the prevention of neural tube defects. *N Engl J Med* 2000; **342**: 1135–37.
- 18 Berry RJ, Gindler J, Botto LD. Folic acid and the prevention of neural tube defects. *N Engl J Med* 2000; **342**: 1135–37.

## Uses of error: Method and bias

I have made errors in medicine when I departed from a systematic approach to consultation or when I allowed some circumstance to bias my clinical judgment. I have learned that mistakes are likely to occur during hurried clinical encounters, or when extraordinary arrangements are made for privileged patients, friends, or colleagues. An error I have found particularly instructive is one that I witnessed; a delayed diagnosis finally solved by a careful senior physician. It has left me with a lingering suspicion as to how I might have performed if challenged alone with the same problem.

During my gastroenterology fellowship I was asked on a late Friday afternoon to see a middle-aged woman on the surgical ward. The request was delivered in the hospital corridor, and the surgical resident sheepishly suggested that I could discharge the patient and arrange outpatient follow-up in order to free a hospital bed. The patient had complained of intermittent abdominal pain, but after extensive investigations and observation, the surgeons had concluded the patient was “non-surgical” and the symptoms were “functional”. As I marched off to see this last patient I happened upon my supervisor who offered to accompany me.

The patient was pleased to hear that the investigations had revealed nothing abnormal, but she was not fully reassured. Although her history was vague, my supervisor established some troubling features in her story. She complained of longstanding alternating bowel habit, but the abdominal pain seemed to be a recent problem. The pain had been severe enough to wake her from sleep on more than one occasion and she had become distended during those episodes. Patients with functional bowel syndrome commonly complain of pain and bloating, but on close listening, her symptoms suggested intermittent bowel obstruction. My supervisor started his methodical physical examination. Without any fuss, he used simple clinical signs to demonstrate that she had a right-sided femoral hernia. A femoral hernia in a woman may be a difficult diagnosis, but it becomes even more so if clinicians are biased by the referral or by negative investigations. My supervisor also managed to maintain the patient's confidence in the referring team. She still required surgery and her welfare would have been jeopardised had she lost confidence in the medical profession. She was successfully operated upon by the referring team and was happy with the outcome. I doubt I would have diagnosed the problem had I seen the patient alone, and the case keeps me humble.

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