INDUCED ABORTION AND SECONDARY INFERTILITY

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Summary

The role of induced (and spontaneous) abortions in the aetiology of secondary sterility was investigated. Obstetric and gynaecologic histories were obtained from 100 women with secondary infertility admitted to the First Department of Obstetrics and Gynaecology of the University of Athens Medical School and to the Division of Fertility and Sterility of that Department. For every patient, an attempt was made to find two healthy control subjects from the same hospital with matching for age, parity, and level of education. Two control subjects each were found for 83 of the index patients. The relative risk of secondary infertility among women with at least one induced abortion and no spontaneous abortions was 3·4 times that among women without any induced or spontaneous abortions (95 per cent confidence interval 1·38–8·37). The relationship was statistically significant and indicated that in Greece, about 45 per cent of the cases of secondary infertility may be attributable to previous induced abortions.

Secondary infertility is among the most publicized possible complications of induced abortion. It is frequently stated (Dykova *et al*, 1960; Midak, 1966) that a high proportion of women who have an induced abortion by dilatation and curettage are subsequently infertile—some authors (Müller, 1966; Louros, 1967) make the number more than 25 per cent. Since cohort studies on the long-term effects of induced abortion are difficult to undertake, existing evidence is mainly based on retrospective studies. A high frequency of induced abortion in patients with secondary infertility has indeed been reported in several studies (Milosevic, 1966; Pontifex *et al*, 1972; Comninos, 1972). However, in most of these studies control groups were not used and therefore the epidemiology of illegal abortion was not taken into account. Furthermore, some of the available studies of the complications of induced abortion (Gebhard *et al*, 1958; Lindahl, 1959; Hayashi and Momose, 1966) failed to show any effect on subsequent fertility. For these reasons we felt a need for a careful specific evaluation of the role of induced (and spontaneous) abortions in the aetiology of secondary infertility. An important objective of the study was to control for factors such as age, parity and socioeconomic status (Gebhard *et al*, 1958; Valaoras *et al*, 1969), since their effect has not been taken into account in most of the earlier

studies. A similar approach was previously used in an investigation of the relationship between induced abortion and ectopic pregnancy (Panayotou et al, 1972).

PATIENTS AND METHODS

Between 1st June, 1973, and 31st May, 1974, some 150 women complaining of secondary infertility were admitted to the First Department of Obstetrics and Gynaecology of the University of Athens Medical School or to the Division of Fertility and Sterility of that department (Alexandra Maternity Hospital). A diagnosis of secondary infertility was accepted if there had been a previous conception, if the patient was married, if the husband had a normal semen analysis and if the patient had been trying to become pregnant for at least 18 months; 110 patients fulfilled these diagnostic criteria and 100 of them were included in the study.

For every patient with secondary infertility, we selected two 'healthy' controls from the maternity department of the same hospital who were matched for age, parity and level of education. Thus if a 32-year-old woman complained of secondary infertility after her third pregnancy (including abortions) then each control subject, in addition to having the same age and level of education, should have been pregnant three times and should have remained fertile. As indication of unchanged fertility we took the occurrence of a subsequent full-term pregnancy (in this example, a fourth pregnancy). Therefore, the control subjects for a patient with secondary infertility after n pregnancies should have been pregnant $(n+1)$ times; however, the last pregnancy was only an indication of fertility and was not taken into account in the analysis. Most control subjects were women in a late stage of their $(n+1)$th pregnancy.

The objective of the matching was to minimize bias (Miettinen, 1970), and the matching factors were, therefore, chosen on the basis of their presumed relation to the occurrence of both induced abortion and secondary sterility (Gebhard et al, 1958; Valaoras et al, 1969). Three categories of education were delineated: less than 6 years, 6 to 11 years, and 12 years or more. Matching of the number of previous pregnancies was exact, while the age of each control subject had to be within three years of the age of the propositus.

Two control subjects each were found for 83 of the index patients and only one each for another four patients. No matching controls were available for the remaining 13 patients. For simplicity of presentation, the analysis was based only on the 83 patients for whom two matching control subjects were found (see Table I and Appendix).

Each patient with secondary infertility was interviewed to determine the number of pregnancies that had ended in induced and spontaneous abortions, and the same information was obtained for the corresponding pregnancies of the control subjects. Eight stillbirths were classified as spontaneous abortions. All induced abortions were illegal and were performed by dilatation and curettage.

RESULTS

For the 83 patients and the 166 matched control subjects the detailed data are given in the Appendix. In Table I the patients and controls are classified according to the reported number of spontaneous and induced abortions.

TABLE I

Distribution of 83 patients with secondary infertility and 166 matched control subjects according to number of induced and spontaneous abortions, and the risk of secondary infertility among women of every group as a ratio to the risk of women with neither induced nor spontaneous abortions

Spontaneous abortions	Induced abortions			
	0	1	2+	Total
0	7/60 1	12/33 $3 \cdot 1 (1 \cdot 2)$	9/20 $3 \cdot 9 (1 \cdot 3)$	28/113 *
1	22/25 $7 \cdot 5 (3 \cdot 1)$	5/11 $3 \cdot 9 (1 \cdot 1)$	4/4 $8 \cdot 6 (2 \cdot 1)$	31/40 $6 \cdot 6 (2 \cdot 8)$
2+	18/11 $14 \cdot 0 (5 \cdot 3)$	6/1 $51 \cdot 4 (10 \cdot 8)$	0/1 †	24/13 $15 \cdot 8 (6 \cdot 2)$
Total	47/96 *	23/45 $4 \cdot 4 (1 \cdot 8)$	13/25 $4 \cdot 5 (1 \cdot 7)$	83/166 *

* Relative risk not calculated because the reference group is included
† Relative risk not calculated because the numbers are too small
In all boxes the results available are arranged as follows:
  No. of patients with infertility in group/No. of controls in group
  Relative risk for group (lower 95 per cent confidence limit of relative risk)

The magnitude of the effect of induced or spontaneous abortion or of their combination may be assessed in terms of the risk ratio (relative risk). This is the ratio of the risk of secondary infertility among women with one or more induced or spontaneous abortions or any combination of them to that among those without any induced or spontaneous abortion. Estimates of relative risks for the various categories of women (Mantel and Haenszel, 1959) as well as their lower confidence limits (Miettinen, 1974) are shown in Table I. It is evident that the risk of secondary infertility is considerably lower among women with neither induced nor spontaneous abortion than among those in any other numerically important group. It is also apparent that spontaneous abortions are more strongly related than induced abortions to secondary infertility. However, the design of our study does not allow us to evaluate the effect of induced abortions while controlling the effect of spontaneous abortions and vice versa (Mantel and Haenszel, 1959) and, therefore, the effect of induced abortions may be better evaluated among the women without spontaneous abortions (first row of Table I) and vice versa (first column of Table I).

COMMENT

So far as we have been able to determine, the present study is the first effort to explore specifically the role of induced and spontaneous abortions in the aetiology of secondary infertility while controlling for extraneous factors such as parity, age, and socioeconomic status.

The association between spontaneous abortions and secondary infertility is statistically highly significant and very strong. However, this relationship may be only partly causal. It is likely that endocrine or local factors, which are causally related to both the occurrence of spontaneous abortion and the development of secondary infertility, are creating a secondary association between the two conditions.

With respect to induced abortions, it seems fair to conclude that, under the conditions of the present study, women who had had one or more of them, but no spontaneous abortions, had a $3 \cdot 4$ times higher risk of secondary infertility (95 per cent confidence interval $1 \cdot 38 – 8 \cdot 37$) than did women without any abortions (induced or spontaneous). However, the magnitude of the relative risk was relatively small and this could explain the negative results of some cohort studies (Lindahl, 1959; Glenc, 1974), in which a much larger number of observations is required for the statistical substantiation of similar findings (Mantel and Haenszel, 1959).

As induced abortion predisposes to secondary infertility by causing pelvic inflammatory disease, the circumstances of the operation would appear to be of crucial importance. Therefore, variations in local conditions must be taken into account when applying our results to other populations. While induced abortions are illegal in Greece (Louros et al, 1974) they are legal in Japan, where a careful controlled study failed to detect any resultant infertility (Hayashi and Momose, 1966).

The proportion of cases of secondary infertility which might be due to previous induced abortions may be estimated from the corresponding relative risk ($=3 \cdot 4$), together with the proportion of exposure (women with at least one previous induced abortion) in the population at risk (Panayotou et al, 1972). Since the proportion of married women reporting one or more induced abortions in Greece is estimated at about 35 per cent (Trichopoulos et al, 1974), it follows that of the cases of secondary infertility 46 per cent

$$\frac{0 \cdot 35 \times (3 \cdot 4 - 1 \cdot 00)}{0 \cdot 35 \times 3 \cdot 4 + 0 \cdot 65 \times 1 \cdot 0}$$

may be attributable to previous induced abortions.

The proportion of women complaining of secondary infertility is not known but it is probably less than 10 per cent (WHO, 1975). Therefore less than 5 per cent of all women in Greece have secondary infertility due to previous induced abortions, even though more than one-third of the married women in Greece admit to at least one illegal abortion (Valaoras et al, 1969; Trichopoulos et al, 1974). Thus, the opinion expressed by several Greek authors that "a very high percentage" (Comninos, 1972) or "about one third" (Louros, 1967) of the women subjected to an induced abortion subsequently remain infertile is not supported by our data. Nevertheless, the existence of a causal relationship of moderate strength between the two phenomena was demonstrated in the present study.

APPENDIX

History of induced and spontaneous abortions in 83 patients with secondary infertility and 166 (2×83) matched controls

Matching category			No. of induced abortions among preceding pregnancies			No. of spontaneous abortions among preceding pregnancies		
Education (years)	Age (± 3 years)	No. of previous pregnancies	Propositus	Control No. 1	Control No. 2	Propositus	Control No. 1	Control No. 2
0–5	26	6	1	3	3	5	0	0
0–5	42	1	1	0	0	0	0	0
0–5	39	6	6	6	3	0	0	0
0–5	34	4	2	0	0	0	1	2
6–11	35	3	1	2	0	1	0	0
6–11	36	4	2	1	0	1	1	2
6–11	23	1	0	0	0	0	0	0
6–11	32	2	0	2	0	0	0	1
6–11	21	1	0	0	1	1	1	0
6–11	28	2	0	0	0	0	1	1
6–11	29	2	1	0	0	0	0	1
6–11	37	4	2	1	0	1	1	1
6–11	31	1	1	0	0	0	0	0
6–11	29	3	2	0	0	0	1	2
6–11	31	2	1	1	1	1	0	0
6–11	27	2	2	1	0	0	0	0
6–11	30	5	4	0	1	1	3	2
6–11	26	1	0	0	1	1	0	0
6–11	25	3	2	0	1	1	1	1
6–11	44	1	0	0	1	1	0	0
6–11	40	1	0	0	0	1	0	0
6–11	35	2	2	0	0	0	0	0
6–11	28	2	0	0	2	2	0	0
6–11	36	1	0	0	0	1	0	1
6–11	27	2	1	0	0	1	1	2
6–11	40	2	0	0	0	2	0	0
6–11	38	2	0	0	0	2	0	0
6–11	34	3	0	0	0	3	0	0
6–11	28	4	1	0	2	3	2	1
6–11	30	4	2	1	1	0	1	1
6–11	32	1	0	0	0	1	0	0
6–11	34	2	1	1	0	0	0	0
6–11	42	1	1	1	0	0	0	0
6–11	32	2	0	0	2	2	0	0
6–11	39	1	1	0	0	0	0	0
6–11	35	2	0	0	0	2	0	0
6–11	36	1	0	0	0	1	0	0
6–11	34	3	1	2	3	2	0	0
6–11	30	3	0	0	0	0	2	1
6–11	28	1	0	1	0	1	0	0
6–11	39	3	0	1	0	3	0	0
6–11	35	1	0	0	0	0	0	0
6–11	41	1	0	0	0	0	0	0
6–11	37	2	1	0	0	1	0	0
12+	30	1	0	1	0	0	0	0
12+	37	1	1	0	0	0	0	1
12+	28	2	0	1	1	2	0	0
12+	27	4	4	2	3	0	1	0
12+	26	2	2	1	1	0	0	0
12+	38	3	0	1	1	2	0	0
12+	24	3	1	2	2	2	1	0

[continued

APPENDIX—continued

Education (years)	Age (± 3 years)	No. of previous pregnancies	No. of induced abortions among preceding pregnancies			No. of spontaneous abortions among preceding pregnancies		
			Propositus	Control No. 1	Control No. 2	Propositus	Control No. 1	Control No. 2
12+	36	5	1	1	3	4	1	1
12+	27	3	1	1	3	1	1	0
12+	28	1	0	1	0	1	0	1
12+	29	2	0	1	1	2	0	1
12+	36	2	0	1	0	2	0	1
12+	28	2	1	1	2	0	1	0
12+	28	2	0	2	1	2	0	0
12+	28	1	0	1	0	1	0	0
12+	27	2	0	1	1	2	0	0
12+	35	2	0	2	1	2	0	0
12+	25	1	0	1	1	1	0	0
12+	34	1	0	0	0	1	0	0
12+	31	2	0	0	1	2	0	0
12+	26	2	1	0	0	0	1	2
12+	32	1	0	0	1	1	0	0
12+	21	1	0	0	0	1	1	0
12+	28	3	1	2	3	2	0	0
12+	37	3	0	1	0	2	1	3
12+	25	1	1	0	1	0	0	0
12+	32	1	1	1	0	0	0	0
12+	25	1	0	0	1	1	0	0
12+	31	1	0	0	0	1	1	0
12+	38	6	0	2	0	5	2	6
12+	26	2	0	0	1	2	2	1
12+	31	1	0	0	1	1	0	0
12+	31	2	0	2	0	1	0	1
12+	25	1	1	0	0	0	0	1
12+	31	1	0	0	0	1	0	1
12+	34	1	0	0	0	1	0	0
12+	35	2	2	0	2	0	0	0
12+	29	1	0	0	0	1	1	1
12+	23	1	0	0	0	1	1	1

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