CLINICAL SCIENCE

Childbearing and risk of cataract in young women: an epidemiological study in central India

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Background/aims: Observations in central India, over a period of more than a decade, suggested that the frequency of sight restoring cataract surgery was substantially higher in women of childbearing age compared to men of the same age. Formal surveys in the subcontinent of India have confirmed a higher prevalence of cataract in women. The present study was conducted to explore possible effects of childbearing and associated adverse factors on cataract risk.

Methods: A case-control study design was used. Cases were mothers aged 35–45 with bilateral "senile" cataract. Controls were mothers of the same age but with clear lenses, attending the hospital services with other, mostly minor, complaints.

Results: A significant association was found between childbearing and risk of sight impairing cataract in mothers. Having more than three babies doubled the risk (adjusted odds ratio 2.0, p=0.012), and the risk increased by an estimated 20% for each additional birth. The birth effect was independent of age, socioeconomic status (occupation and income level), body mass index, and multiple episodes of severe dehydration, all regarded as putative risk factors for cataract.

Conclusions: Having more than three babies may substantially increase the risk of sight impairing cataract in mothers of childbearing age in central India. The findings open new research challenges to identify cataract risk factors to which mothers may be exposed during pregnancy and childbirth, particularly under poor socioeconomic conditions.

Age related "senile" cataract is the commonest eye disorder causing visual impairment and blindness outside of the established market economies of Europe and North America, and cataract extraction constitutes the biggest surgical workload in ophthalmic units throughout the world.[1] The Chattisgarh Eye Hospitals have been serving a mix of urban and rural populations in the Raipur District of Madhya Pradesh in central India for the past 25 years. Observations by the surgical staff working in the hospitals' cataract services indicated that substantial numbers of relatively young women (aged 35–45 years) had been receiving surgery for advanced sight impairing cataract (not congenital, and not due to trauma or secondary to other eye disease), whereas such surgery was very uncommon in men of the same age. "Primary" cataract of this kind at such a relatively young age is extremely rare in the United Kingdom and in other countries forming the established market economies. A formal population based eye survey in the rural population found a higher age standardised prevalence of cataract in young women compared to men (4% versus 2%).[2] Other subsequent surveys in the Indian subcontinent[3 4] have also found that cataract appeared at a younger age in women than men. The Beaver Dam Eye Study in the United States has found evidence suggesting a modest protective effect of oestrogen exposure on the lenses of women.[5] The more recent Blue Mountains Eye Study in Australia[6] has reported that age at menarche was associated with increased prevalence of all types of cataract in women aged 49–97, but that there was no association with age at menopause, number of children, or use of the oral contraceptive pill.

Our study was designed to explore possible causal risk factors for cataract in women of childbearing age. The main focus of the study was to assess the effect of childbearing on risk of cataract in relatively young women.

METHODS

A case-control study design was used. Mothers aged 35–45 attending the Chattisgarh Eye Hospitals' eye care services in Raipur District were potential candidates for the study, and were all invited to participate. The recruitment period was 1 year. Excluded from the study were women who had any of the following: unilateral or traumatic cataract; other secondary or congenital lens opacities; diabetes; and history of long term steroid treatment. Clinical assessments were performed by an ophthalmologist, and interviews conducted by a social scientist, who was masked to the clinical data. The questionnaires on details of pregnancy and childbirth were administered by an obstetrician with local experience. Cases were mothers with bilateral cataract, equivalent to the "Lens Opacity Classification System II" grades 2 or worse[7] for at least one of the three main types of cataract—nuclear, cortical, and posterior subcapsular. Controls were mothers attending for other (mostly minor) complaints, with clear lenses (cataract grade 0) in both eyes. Any patient found to be a non-case (potential control) but who had some "trivial" lens opacity (less than grade 2) was excluded from the study. The aim was to have a group of cases with obvious bilateral cataracts and a group of controls with no lens opacity in either eye. One ophthalmologist graded the lens opacities. The intraobserver agreement was not assessed for this simple classification task—to identify grade 2 or worse (obvious) cataract, and grade 0 (no lens opacity).

Exposures ascertained

Detailed history of pregnancy and childbirth was taken to ascertain the number of births, and included data on birth dates, place and mode of delivery, and practice of a local custom of dietary abstention after birth. Other previously documented risk factors, regarded here as extraneous factors that might be confounders, were age; occupation (outdoor work, mainly casual labour, as indicator of high exposure to ultraviolet sunlight); income levels (income <1000 rupees per month to indicate lowest point); weight and height for body mass index (kg/m^2); and history of severe dehydration as explained in an earlier study.[8] The study was not designed to

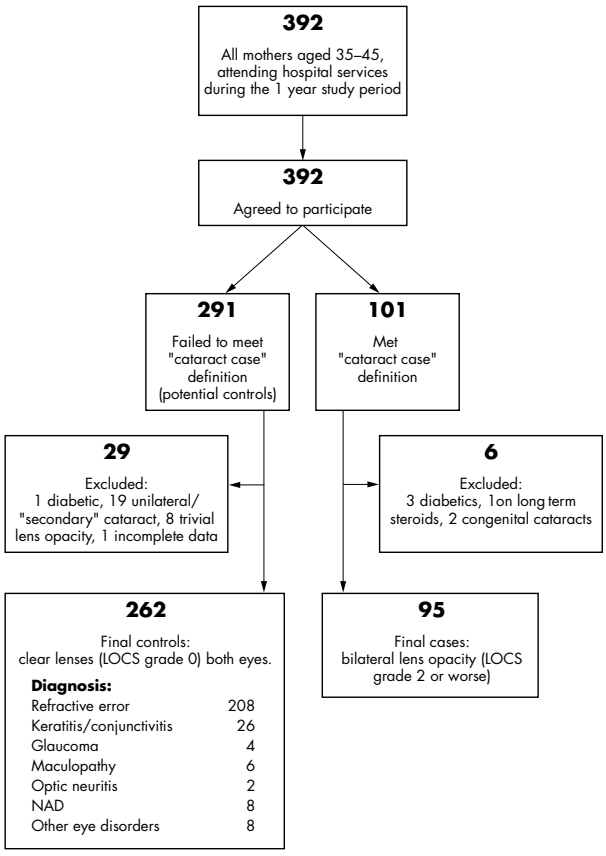

Figure 1 Selection of the study sample, exclusions, and the diagnostic categories for the controls.

investigate these extraneous factors in detail as risk factors for cataract, but sufficient information was collected to allow distinction between extremes of exposure and to enable adjustments for their confounding effects (if any). Smoking, implicated as a risk factor for cataract,[9] was socially unacceptable for women in the local society. Previous experience in the area indicated that women found questions on personal smoking habits highly offensive, and that the few women who were known to be occasional smokers would not admit to it at an interview, so that data on smoking history would have poor validity. We did not collect data on smoking in this study. It is, however, unlikely that smoking status in the study sample would be an important confounder, since no positive links with childbearing have been established, and only very few of the mothers would be expected to have been smokers.

Statistical analysis

Multiple logistic regression was used to assess the effect of number of births on risk of cataract, with adjustment for the confounding effects of the extraneous factors. Further analysis, to assess the effect of the exposure on types of cataract separately, was performed using a multinomial (polychotomous) logistic regression model. For this purpose, women were classified as follows: controls; nuclear cataract only; cortical cataract only; and other mixed cataracts. The only two cases of pure posterior subcapsular lens opacities were grouped with the cortical cataracts. Since age was known to be the most important potential confounder, it was used as a linear term, and as a grouped categorical variable (35–39, 40–45) in separate regression analyses. The number of births was also used as a linear term, and as a categorical variable (arbitrarily grouped as 1–3, 4–6, >6) in separate regression models.

RESULTS

A total of 357 women were eligible for inclusion in the study. Of these, 95 were cataract cases and 262 were controls (no lens opacity in either eye). The selection of the study sample, the exclusions, and the diagnostic categories for the controls are depicted in Figure 1. The characteristics of the cases and controls are compared in Table 1.

Number of births was significantly associated with risk of cataract. The odds ratio was 1.2 (95% confidence limits 1.1 to 1.4, p=0.003) after adjustment for effects of age, outdoor work, and body mass index, indicating a 20% increase in risk for each additional childbirth. When the number of births was used as a grouped variable, there was an increasing trend in risk of cataract with increasing number of births. The adjusted odds ratio for more than six births was 4.1 (95%CL 1.7 to 10.0, p=0.001), and for four to six births was 1.7 (95% CL 1.0 to 2.9, p=0.067), all compared to the referent level of one to three

Table 1 Characteristics of the 262 control mothers and the 95 cataract cases. The odds ratios are unadjusted for confounding

Characteristics	Number (%)			
	Controls	Cataract cases	Odds ratio (95% CL)	p Value
Age (years):				
35–39	91 (34.7)	12 (12.6)	1 (referent)	
40–45	171 (65.3)	83 (87.4)	3.7 (1.9 to 7.0)	<0.001
Outdoor work:	34 (13.0)	32 (33.7)	3.4 (2.0 to 5.9)	<0.001
Low income (<1000 rupees/month)	82 (31.3)	69 (72.6)	5.8 (3.5 to 9.8)	<0.001
Body mass index (quartiles):				
13.7–18.7	52 (19.8)	37 (38.9)	1 (referent)	
–21.4	62 (23.7)	29 (30.5)	0.7 (0.4 to 1.2)	0.178
–24.5	71 (27.1)	18 (18.9)	0.4 (0.2 to 0.7)	0.002
–43.8	77 (29.4)	11 (11.6)	0.2 (0.1 to 0.4)	<0.001
Childbearing:				
1–3 babies	134 (51.2)	31 (32.6)	1 (referent)	
4–6 babies	114 (43.5)	49 (51.6)	1.9 (1.1 to 3.1)	0.018
7–11 babies	14 (5.3)	15 (15.8)	4.6 (2.0 to 10.6)	<0.001
>3 babies	128 (48.9)	64 (67.4)	2.2 (1.3 to 3.5)	0.003
Pregnancies:				
1–3	93 (35.5)	25 (26.3)	1 (referent)	
4–6	138 (52.7)	52 (54.7)	1.4 (0.8 to 2.4)	0.224
7–11	31 (11.8)	18 (18.9)	2.2 (1.0 to 4.5)	0.037

Table 2 Multiple logistic regression analysis of the association between childbearing and risk of cataract, with adjustment for the confounding effects of extraneous factors

Variables in the regression model	Odds ratio (95% CL)	p Value
Model 1		
Childbearing (linear term)	1.2 (1.1 to 1.4)	0.003
Extraneous variables:		
Age: 40–45 *v* 35–39	3.8 (1.9 to 7.6)	<0.001
Outdoor work	2.9 (1.6 to 5.4)	0.001
Body mass Index (linear term)	0.9 (0.8 to 1.0)	0.003
Model 2		
Childbearing: >3 babies	2.0 (1.2 to 3.3)	0.012
Extraneous variables:		
Age: 40–45 *v* 35–39	4.0 (2.0 to 8.0)	<0.001
Outdoor work	2.8 (1.5 to 5.2)	0.001
Body mass index (linear term)	0.9 (0.8 to 1.0)	0.003

births. More than three births doubled the risk of cataract (odds ratio 2.0, 95%CL 1.2 to 3.3, p=0.012). There was no significant effect modification by any of the extraneous variables. The details are shown in Table 2.

The findings were not materially changed after further adjustment for income level or for severe dehydration, the odds ratio for childbearing remaining at 1.2 (95% CL 1.06 to 1.41, p<0.01). Using age as a linear term, instead of a binomial categorical variable, resulted in only a small reduction in the odds ratio for number of births (from 1.22 to 1.17), remaining significant (95% CL 1.02 to 1.34, p=0.027).

Looking at the three main types of cataract separately, the multinomial logistic regression results showed that the number of births was associated with higher risk of mixed cataracts (odds ratio 1.2, p=0.009); pure nuclear cataracts (1.2, p=0.054); and cortical cataracts (odds ratio 1.2, p=0.373), the latter being based on small number (nine) of cases.

The associations between the extraneous factors and cataract were as expected—in line with other major studies of cataract risk factors.[7] Thus, the following factors were significantly associated with cataract risk (Table 2): age (odds ratio 3.8 for the 40–45 group, p<0.001), outdoor work (odds ratio 2.9, p=0.001), body mass index (odds ratio 0.9, p=0.003), and low income (odds ratio 5.0, p<0.001 for monthly income <1000 rupees), when the "outdoor work" term was replaced by "income" in model 1. The two terms were not included simultaneously in the same regression model because of the extreme correlation between them.

DISCUSSION

This study suggests that childbirth may be an important risk factor for cataract in mothers, and that having more than three babies increases the risk of cataract substantially in the study population. The birth effect seems to be independent of age (within the range 35–45), nutritional status (as measured by the body mass index), and socioeconomic status (loosely defined by income level and occupation).

It may be argued that the low income mothers had more children and were more likely to attend the hospital service for serious eye problems such as cataract, whereas women of higher socioeconomic status might have fewer children and were more likely to attend with relatively minor complaints, and that this difference in use of services might explain the study findings. We found no evidence for this. An analysis was performed using the data on 151 mothers of the lowest income strata—a homogeneously poor group. The result in this subgroup also indicated a doubling of cataract risk in mothers with more than three births (odds ratio: 2.0, 95% CL 1.0 to 4.0, p=0.049), after adjustment for age, body mass index, and occupation.

The birth effect does not seem to be mediated through the potentially adverse local practice of fluid abstention after birth (possibly causing severe dehydration), which was found to be strongly associated with cataract in this study. Some possible explanations for the birth effect in the study population may be speculated. These include increasing exposure to episodes of acute nutritional deficiencies (undetected by body mass index) with increasing number of births; higher exposure to episodic increase in blood urea levels leading to cyanate induced carbamylation of the lens proteins; episodes of hyperglycaemia during pregnancy (leading to glycation of lens proteins), and possibly a complex of other adverse factors related to the stress of many pregnancies and the care of many babies.

The data on number of live births were validated through careful ascertainment of the year of birth, and the number and status of the children in the family. Our data on reported stillbirths (36/357, 10%) and abortions (105/357, 29%) could not be so fully validated. Neither, however, was found to be associated with cataract risk in our study, nor did they have an appreciable confounding effect.

Most of the cases (58/95) in this study had mixed cataract, leaving only nine "pure" cortical and 28 "pure" nuclear cataract cases. In spite of these small numbers of so called pure types of cataract, the odds ratios for each type were virtually identical. In any case, the main interest here was the effect of the exposure factor on the risk of sight impairing cataract as a whole, not on a particular type of cataract defined by anatomical position.

In conclusion, having more than three babies may substantially increase the risk of sight impairing cataract in mothers of childbearing age in central India. The findings open new research challenges to identify cataract risk factors to which mothers may be exposed during pregnancy and childbirth, particularly under poor socioeconomic conditions.

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