Possible Associations Between Computed Tomography Scan and Cataract: The Blue Mountains Eye Study

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ABSTRACT

Objectives. This study examined possible associations between the presence of cataract and a history of computed tomography (CT) scan of the head in an older population.

Methods. The Blue Mountains Eye Study examined 3654 people aged 49 to 97 years who lived west of Sydney, Australia. As part of a medical history, participants were asked whether they had ever had a head CT scan. Masked grading of lens photographs assessed cortical, nuclear, and posterior subcapsular cataracts.

Results. No significant associations were found between history of head CT scan and age- and sex-specific prevalence of any type of cataract.

Conclusions. This study provided no evidence to support an association between routine head CT scans and development of cataract. (*Am J Public Health.* 1999;89:1864–1866)

In 1993, the Beaver Dam Eye Study reported that both nuclear and posterior subcapsular cataracts were associated with a history of head computed tomography (CT) scan.[1] Cataracts have been reported in atom-bomb survivors,[2] workers exposed to radiation, and patients receiving therapeutic radiation.[3] Diagnostic use of CT scans is now widespread[3,4] and often supersedes preoperative plain radiography.[5] The Beaver Dam report raised concern about radiation sustained from head CT scans and the potential for cataract formation, particularly in patients who need multiple scans as part of treatment.[3,6,7] Substantial cumulative radiation to the lens has been reported in children undergoing frequent CT scans,[3] although a cadaver study found that a single paranasal sinus scan delivered around 4% of the presumed cataractogenic dose.[7] Another study reported that some CT techniques could exceed threshold doses for cataractogenesis.[6]

Apart from the Beaver Dam report, this association has not been examined in other populations. In our study of older Australians, we included questions about a history of head CT scans. We aimed to determine whether an association existed between the presence of cataract and a history of head CT scan in this population.

Methods

The Blue Mountains Eye Study was a population-based survey of common eye diseases in an urban population aged 49 to 97 years (56.7% women and 43.3% men) who lived west of Sydney, Australia. Survey methods have been previously described.[8] Of 4433 eligible residents, 3654 persons (82.4%) gave informed consent and had a detailed eye examination during 1992 through 1994.

One of 2 masked graders used the Wisconsin system[9] to assess lens photographs, with high intergrader and intragrader reproducibility.[10] Three cataract types (nuclear, cortical, and posterior subcapsular) were graded. Analyses used the worse affected eye and excluded 108 persons who had undergone bilateral cataract surgery. Participants were asked whether they had ever had a head CT scan, how many, and what year scans were performed. Twenty-four subjects reported having had a CT scan before 1976 (the year that CT scan became readily available in Sydney). These subjects and 58 people who could not remember whether they had ever had a CT scan were excluded. Logistic regression was used to assess the relation between CT scan and cataract, with adjustment for age and sex. Odds ratios (ORs) and 95% confidence intervals (CIs) are presented in the following section.

Results

A history of head CT scan was reported by 18% of the participants (651 of 3546), slightly higher in men (20%) than in women (17%). A slight age-related increase in CT scan prevalence was found in men ($\chi^2_1 = 6.5$, $P = .01$) but not in women.

Cataract prevalence rates in persons with a head CT scan history were similar to rates in persons without a CT scan history (Table 1). In general, no clear relation was seen between history of CT scans and presence of cataract (Table 2). This finding was not altered when analyses included persons who reported having had a CT scan before 1976 (data not presented). However, for more than 1 scan, some suggestion of increased nuclear cataract prevalence (OR = 1.7, 95% CI = 0.8, 3.5) was found. Having more than one head CT scan was associated with a higher nuclear cataract prevalence in men (age-adjusted OR = 2.7, 95% CI = 1.1, 6.9) but not in women. After adjustment for other known cataract risk factors, including education, hypertension, diabetes, smoking, alcohol use, steroid use, and sun-related skin damage, the odds ratio in men became nonsignificant (OR = 2.4, 95% CI = 0.8, 7.4). The risk was not increased for any cataract type in persons reporting having had a CT scan before 1986.

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Discussion

Our findings can be compared directly with the Beaver Dam Eye Study report.[1] The 2 studies had a similar age and sex distribution and used similar methods, including lens photograph grading.[9] Age-specific prevalence rates for each cataract type[8] and CT scan prevalence rates in our population were similar to those in the Beaver Dam study.[1] However, our study found no statistically significant association between CT scan history and cataract presence, whereas the Beaver Dam study found a modest positive association between CT scan history and nuclear or posterior subcapsular cataract (Table 2).

Although the total radiation dose from head CT scans may have differed between the 2 populations, this seems unlikely to explain the differences, because the same CT scanners are used in both countries.

Our study had more than 85% power to detect odds ratios greater than 1.5 for nuclear and cortical cataract. However, the relatively small number of posterior subcapsular cataract cases means that we could have overlooked a weak association between posterior subcapsular cataract and head CT scan. The study had 35% power to detect an odds ratio of 1.5 for posterior subcapsular cataract and CT scan and 80% power to detect an odds ratio of 2.0.

Could the different results be explained by methodological differences? For example, we excluded from analyses persons unable to provide adequate information on CT scan history, whereas these persons were categorized as not having had a CT scan in the Beaver Dam Eye Study. We repeated analyses to include persons with inadequate CT scan history, but the results were unchanged (data not presented). We had a higher proportion of missing data, particularly for nuclear cataract, mainly because of photographs considered less than ideal for grading.[8]

Although having more than 1 CT scan was associated with higher age-adjusted prevalence of nuclear cataract in men, this may well have been a chance association, because the age-adjusted risk of nuclear cataract in persons who had more than 1 CT scan was similar in men and women (Breslow-Day test for heterogeneity of odds ratios, $P = .3$).

We used the Mantel-Haenszel method to pool age- and sex-adjusted odds ratios from our study with those from the Beaver Dam report. The pooled odds ratios for ever having had a head CT scan were 1.22 (95% CI = 0.96, 1.54) for posterior subcapsular cataract and 1.00 (95% CI = 0.84, 1.20) for cortical cataract. This meta-analysis showed no statistically significant association between CT scan and cataract. However, a slightly increased posterior subcapsular risk cannot be excluded. We did not pool results for nuclear cataract because of statistical evidence of heterogeneity ($P = .02$) between the 2 studies.

TABLE 1—Prevalence of Cataract Types According to Head Computed Tomography (CT) Scan History: Blue Mountains Eye Study, Australia, 1992–1994

	Cataract Type		
	Cortical, No. (%)	Nuclear, No. (%)	Posterior Subcapsular, No. (%)
Head CT scan			
No	661/2744 (24)	367/1985 (18)	175/2752 (6)
Yes	135/613 (22)	77/451 (17)	37/614 (6)
No. of scans			
0	661/2744 (24)	367/1985 (18)	175/2752 (6)
1	121/542 (22)	65/402 (16)	33/543 (6)
>1	14/71 (20)	12/49 (24)	4/71 (6)
Year of CT scan			
1986–1993	101/451 (22)	54/329 (16)	27/452 (6)
1976–1985	34/162 (21)	23/122 (19)	10/162 (6)

TABLE 2—Age- and Sex-Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for Association Between Head Computed Tomography (CT) Scan and Presence of Cataract

	Cataract Type		
	Cortical, OR (95% CI)	Nuclear, OR (95% CI)	Posterior Subcapsular, OR (95% CI)
Head CT scan			
No	1.0 (referent)	1.0 (referent)	1.0 (referent)
Yes	0.9 (0.7, 1.1)	0.8 (0.6, 1.1)	0.9 (0.6, 1.3)
Beaver Dam Eye Study[a]	1.2 (0.9, 1.6)	1.3 (1.0, 1.6)	1.5 (1.1, 2.0)
No. of CT scans			
0	1.0 (referent)	1.0 (referent)	1.0 (referent)
1	0.9 (0.7, 1.1)	0.8 (0.5, 1.0)	0.9 (0.6, 1.4)
>1	0.9 (0.5, 1.6)	1.7 (0.8, 3.5)	1.0 (0.4, 2.7)
Year of CT scan[b]			
1986–1993	0.8 (0.7, 1.1)	0.8 (0.5, 1.1)	0.9 (0.6, 1.4)
1976–1985	0.9 (0.6, 1.3)	1.0 (0.6, 1.6)	1.0 (0.5, 1.9)

[a]See reference 1.
[b]Referent includes participants who had never had a head CT scan.

We found a nonsignificant increased prevalence of nuclear cataract in subjects who had had more than 1 head CT scan, but no change in prevalence of other cataract types. Our negative finding is not surprising, given recent data indicating radiation exposure from routine head CT scans of 2.5 R to 8 R,[7] well below the estimated minimum 200-R dose in documented radiation-induced cataract.[11] The average 8-year latency period in this study between low-dose (200–650 R) radiation and cataract development[11] supports the lack of an association between history of CT scan before 1986 and presence of cataract in our study.

An important limitation of our study is that we did not validate self-reports of head CT scans. Some participants may have been wrongly classified as exposed or nonexposed. Another limitation is that we had no information on cataract type in those persons who had had bilateral cataract surgery. Analyses to approximate the effect of their omission, by including these cases in all cataract groups, yielded similar results (data not presented). Strengths of our study include its high participation rate and the careful, masked assessment of cataract type and severity as a result of using an established and validated protocol.

In conclusion, we found no convincing evidence that routine head CT scans are harmful to the lens. The Beaver Dam Eye Study,[1] the only other population-based assessment of the relation between CT scan and cataract, provided only weak evidence of a positive association. Despite our findings, strict protocols should be maintained to limit indiscriminant CT scan use and to reduce the radiation dose. □

Contributors

F. Hourihan and R. Cumming conducted the data analyses. P. Mitchell designed the study, examined all of the participants, and performed the lens photography. All of the authors contributed to writing the manuscript.

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Encouraging Use of Coupons to Stimulate Condom Purchase

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ABSTRACT

Objectives. This study examined the feasibility of using high-value coupons to induce condom purchase and evaluated execution factors that can influence the effectiveness of this form of promotion.

Methods. Two levels of coupon discount value (10% off and 75% off) were used to promote condom purchase among young adults. Coupons were distributed according to a widespread strategy or a more focused in-store disbursement method.

Results. Redemption of coupons distributed through the widespread disbursement strategy was negligible. In contrast, coupons from the in-store distribution method, particularly the higher value coupon, resulted in a high redemption rate.

Conclusions. This research provides strong evidence that discount coupons, particularly high-value ones distributed at the purchase location, can be used successfully as a condom promotional incentive. (*Am J Public Health.* 1999; 89:1866–1869)

Inconsistent use of condoms among sexually active people continues to be one of the major factors contributing to the spread of sexually transmitted diseases.[1] There are a number of reasons why condoms are not used,[2–4] including lack of availability[5–7]: If a person does not have a condom, one cannot be used.

One approach to increasing the availability of condoms is to distribute them at no charge.[8] However, giveaways are often single-time promotions that provide only one or two condoms per person; in other cases, condoms are available at limited distribution sites and at specific times. Moreover, organizations that provide condoms free of charge often do not have the resources to make them available in large quantities.[9]

In contrast, in North America at least, condoms are readily and continually available in drugstores and other retail outlets. It would seem that health organizations could increase the use of condoms if they could convince people to purchase condoms regularly from such outlets. However, barriers to condom purchase (e.g., embarrassment, cost) have limited the success of programs that seek to increase purchase rates.[9–11]

One way to stimulate purchase in retail outlets is through the use of promotional incentives. The purpose of the present investigation was to assess the viability of using high-value coupons to induce condom purchases and to identify critical execution factors (i.e., distribution methods, coupon characteristics) that would result in the effectiveness of this promotional strategy.

Methods

Study Design

The study was conducted in Vancouver, British Columbia, Canada, over a span

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