Objective: To determine the incidence of retinal detachment (RD) operations in a multiracial Southeast Asian population.


Methods: Information on all RD operations performed for rhegmatogenous RD (International Classification of Diseases, Ninth Revision, Clinical Modification code 361.0) between 1993 and 1996 was retrieved and analyzed from a population-wide, government-administered medical savings database. Exudative, tractional, and unoperated-on rhegmatogenous RD are excluded. The 1990 Singapore population census was used to allow an estimation of age-, sex-, and race-specific annual incidence of RD.

Results: Between 1993 and 1996, 1126 RD operations were performed on Singapore residents. The average annual incidence of RD operations was 10.5 per 100,000 population (95% confidence interval [CI], 10.2-10.9). The annual incidence was highest for Chinese (age-adjusted incidence, 11.6 per 100,000), followed by Malays (7.0 per 100,000), and lowest for Indians (3.9 per 100,000). The age-adjusted relative risk of RD operation for Chinese compared with Indians was 3.0 (95% CI, 2.9-3.1). Males were twice as likely as females to require RD surgery (age-adjusted relative risk, 2.0; 95% CI, 1.7-2.4). Chinese men 40 years and older had a 30.9 times higher risk (95% CI, 9.9-96.1) than Indian females younger than 40 years.

Conclusion: The incidence of RD is strongly associated with male sex and ethnic origin.


Despite the fact that retinal detachment (RD) is an important, potentially blinding ocular condition, there are few population-based studies on the incidence of RD in the world. This is not surprising when the major prerequisite for such studies is a closed and stable population from which rates can be calculated.

In the United States, 2 recent studies estimated the annual incidence of RD at approximately 12 per 100,000 population both in Iowa and Minnesota. Both studies indicated a marked increase in the incidence of those older than 50 years. In Europe, an annual incidence of 4 per 100,000 population was estimated in Switzerland in 1956, but recent reports suggested it is higher, with an annual incidence of 7 to 10 per 100,000 reported from Finland and Sweden, respectively.

The only study conducted on an Asian population was done in Japan, where an annual incidence of 10.4 RD per 100,000 population was estimated. However, there are no population-based data on the incidence of RD in Chinese or other Asian ethnic groups. There is concern that Asian populations might be at higher risk for RD than white populations because of the greater prevalence and severity of axial myopia.

This study describes the epidemiology of RD in Singapore, which has a multiracial Asian population, and estimates the age-, sex-, and race-specific incidence of RD. This information is important for planning and allocating ophthalmic and research resources in Asia.

RESULTS

Between 1993 and 1996, 1228 RD operations were performed in Singapore on Singapore citizens and permanent residents. One hundred two RD operations were performed on persons classified in the “others” racial category and were excluded from further analysis.

Of the remaining 1126 RD operations, 1000 were performed on Chinese, 96 on Malays, and 30 on Indians. Three hundred nineteen RD operations (28.3%) were performed in the private sector, 759 (67.4%) were performed at the SNEC, and the remainder in either National University Hospital or Tan Tock Seng Hospital. There were no major differences in the de-
MATERIALS AND METHODS

Singapore is a primarily urban island nation of 624 km² (240 sq mi), located in Southeast Asia. It has a multiracial population of about 2.7 million people, of which 78% are Chinese, 14% Malay, 6% Indians, and 1% other racial groups. The study population consisted of all citizens and permanent residents of Singapore, who are identifiable by a unique identity card number assigned to all Singapore residents. Ophthalmic care is provided by either the 3 public hospitals with ophthalmology departments (Singapore National Eye Centre [SNEC], National University Hospital, and Tan Tock Seng Hospital) or 3 private hospitals.

The health care financing structure in Singapore revolves around the Medisave fund, a national, government-administered medical savings scheme that is available only to Singapore citizens and permanent residents. The Medisave fund in Singapore has been described in detail in other literature. All working individuals, including self-employed persons, are required by law to contribute 6% to 8% of their monthly income to Medisave. The individual and his or her dependents may use his or her Medisave to pay for up to 80% of hospitalization and medical procedure costs in both the public and private sectors. As of December 1995, there were approximately 2.4 million individual Medisave accounts in Singapore (88% of population). In addition, Medisave is backed by 2 other national health care financing schemes—Medishield, which is a “catastrophic illness insurance,” and Medifund, which is a government grant for the small number of people without adequate Medisave funds or family support. These 3 schemes ensure almost universal health care coverage of all Singapore citizens, permanent residents, and their dependents.

The Ministry of Health’s (MOH) Epidemiology and Disease Control Division regulates the use of the Medisave fund for all medical bills in both the public and private sectors. In July 1990, the Central Claims Processing System was established to collect data on all cases where Medisave claims were made in Singapore (Epidemiology and Disease Control Division, Ministry of Health, Singapore, written communication, November 1997).

For reimbursement purposes, operations in Medisave are classified according to complexity of procedure. There are a total of 98 separate billing categories for ophthalmic operations, ranging from simple lid operations (eg, incision and drainage of chalazia) to complex intraocular surgeries (eg, corneal transplant with cataract extraction and intraocular lens implantation). Retinal detachment operations are classified into 1 of the following 4 categories: (1) “simple scleral buckling” (operations with a single buckle), (2) “complex RD operations” (including encirclage scleral buckles and operations needing more than 1 buckle), (3) “simple pars plana vitrectomies with or without use of scleral buckles,” and (4) “complex pars plana vitrectomies” (including vitrectomies with lensectomy, use of silicone oil, and giant tear repair). Adjunctive procedures to the primary RD operation, such as endolaser or cryopexy of the retinal break and subretinal fluid drainage, do not have separate billing codes.

The reimbursement in Medisave follows strict guidelines. A patient may not be charged twice for the same disease on the same occasion. For example, a patient receiving a vitrectomy and a scleral buckle for an RD cannot be charged for 2 operations. In general, the patient will be charged for the more expensive operation, in this case, the vitrectomy. Also, if the patient subsequently requires a second operation for a redetachment of the retina after the initial operation, a new procedural code is used: “Revision of detachment surgery.” Therefore, there was little possibility that patients would be counted twice from this Medisave classification scheme. Fellow eyes with RD, however, are counted as separate cases. The data are not identifiable by eyes. Yearly audits are carried out by the Professional Medisave Audit Unit in the MOH to assess the accuracy of the surgical coding of the Medisave data. Between 5% to 10% of surgical codes are checked against the actual operations in the case records of each hospital during each audit. At the SNEC, recent audits conducted on 100 operations (October 1996) and 57 operations (September 1997) revealed no discrepancies between patients’ case records and Medisave claims data (Epidemiology and Disease Control Division, MOH, Singapore, written communication, November 1997).

For this study, RD operation data were extracted for the 4 categories of operations and were then cross-checked to ensure a concomitant diagnosis of “RD with tear” (International Classification of Disease, Ninth Revision, Clinical Modification [ICD-9] code 361.0). Using these inclusion criteria, between January 1, 1993, and December 31, 1996, a total of 1228 RD operations were performed on Singapore citizens and permanent residents. This study excludes retinoschisis and retinal cysts (ICD-9 code 361.1), serous RDs (ICD-9 code 361.2), retinal tears without detachments (ICD-9 code 361.3), and tractional RDs (ICD-9 code 361.8).

For the denominator, population data were abstracted from the 1990 census in Singapore (Table 1). Racial groups were defined in the census according to 1 of 4 main ethnic groups: Chinese (refers to persons of Chinese origin such as Hokkiens, Teochew, Cantonese, and Hakka), Malays (refers to persons of Malay or Indonesian origin, such as Javanese), Indians (refers to persons of Indian, Pakistani, Bangladeshi, and Sri Lankan origin, such as Tamils, Bengalis), and others (comprising all persons other than the first 3 categories, such as European, Eurasian, Arab, and Japanese). Persons of mixed heritage were classified under the ethnic group of their fathers. However, this group is not prevalent in Singapore because the incidence of interracial marriages is low due to religious and social differences among ethnic groups. As the “others” racial category includes multiple ethnic populations and is not as clearly defined in the Medisave database as in the census, incidence data on this group were not analyzed in this study.

Age-adjusted incidence rates were computed by direct adjustment using the total population from the 1990 Singapore census. Relative risks and 95% confidence intervals (CIs) were calculated to estimate the effect of age, sex, and race on the incidence of RD operations.

During the 4-year study period, the average annual incidence of RD surgery was 10.6 per 100 000 (95% CI, 10.2-10.9). The annual incidence per 100 000 for the 4 years was 9.1 (95% CI, 7.9-10.2) in 1993, 9.6 (95% CI, 8.5-10.8) in 1994, 11.4 (95% CI, 10.2-12.7) in 1995, and 10.5 (95% CI, 9.3-11.7) in 1996.
The rate of RD surgical procedures by age group, race, and sex is shown in Table 3. The highest rate occurred in Chinese men 40 to 59 years of age (average incidence, 25.0 per 100,000), while in Indian females younger than 20 years old, no RD operation was performed during the entire 4-year study period. Chinese men 40 years or older had a 30.9 times higher risk (95% CI, 9.9-96.1) of having an RD operation compared with Indian females younger than 40 years (Table 4). The higher risk in the older groups and in the male sex was seen across all racial groups.

**COMMENT**

Singapore is uniquely qualified for a study on the incidence of RD in an Asian population. Singapore has a well-defined study area and stable population. The existence of a unique identity number precludes foreigners and counting RD operations twice. Since there are virtually no limitations in access to health care for the majority of Singapore residents, few RD cases would be undetected and untreated for long periods. Patients with RD are not denied RD operations because of financial difficulties in payment. The Medisave database will capture nearly all RD operations performed for Singapore citizens and residents because of the widespread coverage of this fund and because RD operations are generally expensive. In addition, Singapore has well-trained retinal surgeons, and it is unlikely that significant number of patients with RD will seek treatment outside the country. The multiracial mix of the population provided an opportunity to study racial differences in incidence of RD. Of greater public health significance, as the population consists predominantly of first- and second-generation migrants from southern China, Malaysia, and India, we could generalize our study findings to estimate the incidence of RD in China, India, and other Southeast Asian populations.

**Table 1. Census Data of Singapore, 1990**

<table>
<thead>
<tr>
<th>Age Group, y</th>
<th>Total for each category</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>330,073 (31.2)</td>
<td>306,580 (29.3)</td>
<td>73,217 (37.5)</td>
<td>68,807 (36.7)</td>
<td>30,552 (29.6)</td>
<td>28,687 (32.8)</td>
<td>5,000 (35.9)</td>
<td>4,715 (31.8)</td>
<td>847,685 (31.3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-39</td>
<td>418,261 (39.5)</td>
<td>404,043 (38.7)</td>
<td>79,063 (40.5)</td>
<td>75,473 (40.3)</td>
<td>38,357 (37.1)</td>
<td>36,675 (41.9)</td>
<td>4,438 (31.9)</td>
<td>5,411 (36.5)</td>
<td>1,061,719 (39.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-59</td>
<td>224,212 (21.2)</td>
<td>222,113 (21.3)</td>
<td>28,296 (14.5)</td>
<td>30,359 (16.2)</td>
<td>20,935 (20.2)</td>
<td>17,076 (19.5)</td>
<td>2,908 (20.9)</td>
<td>2,945 (19.8)</td>
<td>548,844 (20.3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥60</td>
<td>85,020 (8.0)</td>
<td>112,493 (10.8)</td>
<td>14,565 (7.5)</td>
<td>12,822 (6.8)</td>
<td>13,540 (13.1)</td>
<td>5,085 (5.8)</td>
<td>1,570 (11.3)</td>
<td>1,772 (11.9)</td>
<td>246,867 (9.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,057,566</td>
<td>1,045,229</td>
<td>195,195</td>
<td>187,461</td>
<td>103,384</td>
<td>87,523</td>
<td>13,914</td>
<td>14,843</td>
<td>2,705,115</td>
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<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Table 2. Crude and Age-Adjusted Annual Incidence (per 100,000) of RD Operations, 1993-1996**

<table>
<thead>
<tr>
<th>Category</th>
<th>No. (%)</th>
<th>Crude Annual Incidence per 100,000 (95% CI)</th>
<th>Age-Adjusted Annual Incidence per 100,000 (95% CI)</th>
<th>Relative Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age-specific</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20 y</td>
<td>77 (6.8)</td>
<td>2.3 (1.8-2.8)</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>20-39 y</td>
<td>328 (29.1)</td>
<td>7.8 (7.0-8.6)</td>
<td>...</td>
<td>1.0†</td>
</tr>
<tr>
<td>40-60 y</td>
<td>508 (45.1)</td>
<td>23.4 (21.4-25.4)</td>
<td>...</td>
<td>10.2 (8.0-12.9)</td>
</tr>
<tr>
<td>&gt;60 y</td>
<td>213 (19.0)</td>
<td>21.9 (19.0-24.8)</td>
<td>...</td>
<td>9.5 (7.3-12.3)</td>
</tr>
<tr>
<td>Sex-specific</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>747 (66.3)</td>
<td>13.8 (13.2-14.3)</td>
<td>14.0 (12.6-15.4)</td>
<td>2.0 (1.7-2.4)</td>
</tr>
<tr>
<td>Females</td>
<td>379 (33.7)</td>
<td>7.2 (6.5-7.9)</td>
<td>7.9 (6.1-8.1)</td>
<td>1.0†</td>
</tr>
<tr>
<td>Race-specific</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chinese</td>
<td>1000 (88.8)</td>
<td>11.9 (11.5-12.3)</td>
<td>11.6 (10.3-12.9)</td>
<td>3.0 (2.4-3.7)</td>
</tr>
<tr>
<td>Malays</td>
<td>96 (8.5)</td>
<td>6.3 (5.0-7.5)</td>
<td>7.0 (6.0-8.0)</td>
<td>1.8 (1.4-2.3)</td>
</tr>
<tr>
<td>Indians</td>
<td>30 (2.7)</td>
<td>3.9 (2.5-5.3)</td>
<td>3.9 (3.1-4.6)</td>
<td>1.0†</td>
</tr>
</tbody>
</table>

*Age-adjusted to total Singapore 1990 census population. RD indicates retinal detachment; CI, confidence interval. Ellipses indicate data not applicable.
†Reference group.
Our study indicated an annual incidence of rhegmatogenous RD of 10.5 per 100,000 population. This estimate was further strengthened by the fact that the annual incidence during the 4-year period was relatively constant. Our incidence was consistent with most other population-based studies in the West and Japan, where annual incidences of between 7 to 12 per 100,000 population have been reported. The rates between these studies are not directly comparable because of different case definitions and inclusion criteria.

As this study was based on RD operations data, the true incidence of RD in Singapore may be underestimated or overestimated. For example, unoperated-on RDs are not captured in this database, although this number is likely to be small because of easy access to health care in Singapore. Cases of early RD and subclinical RD treated with cryotherapy or laser therapy as outpatient procedures are also not reflected in our study. Newer procedures such as pneumoretinopexy do not have Medisave claim codes but are performed infrequently because of the financial disincentive for patients. An overestimation of the true incidence can occur if the number of bilateral RD in our population is high, as fellow eyes with RD are counted as separate cases in this study.

Retinal detachment has several well-characterized demographic characteristics reported previously. Age is an independent risk factor for RD in nearly every population-based study. The strong effect of age was similarly found in our study across all 3 racial groups.

There is no clear-cut relationship between sex and RD. No sex association was reported in some studies. In Japan, females were reported to have a slightly higher overall incidence of RD than males. In Sweden, the higher risk in females was confined to the nontraumatic RD group. Our study shows a 2-fold higher rate of RD in males compared with females. The rate of RD in males was consistently higher than females across all racial groups. One possible explanation of this difference is that RD secondary to ocular trauma may be higher in Singapore males than females. However, the attributable risk of RD from ocular trauma is reportedly low and will not fully account for the big difference seen. Whether the excess risk in males reflects a difference in the effect of sex on risk of RD as compared with other populations cannot be evaluated, but it is a clear possibility given the population-based approach used in our study.

There are no reliable studies on racial differences in the incidence of RD. We found a 3-fold higher risk of RD in Chinese compared with Indians, while Malays had a 1.8 times higher risk than Indians. This may be related to refractive status, as the prevalence of myopia appears to be higher in Chinese than in Malays or Indians. A study on 8000 schoolchildren 10 years of age showed that 30% of Chinese were myopic, twice the prevalence in Malays and Indians. In another study on 15,095 National Service pre-enlistees aged 16 to 23 years, the prevalence of myopia in Chinese, Malays, and Indians was 73.3%, 51.1%, and 56.3%, respectively. However, whether this racial difference holds in the older age groups where the risk of RD is highest is not known. Differences in the rate of cataract surgery between the racial groups (eg, higher cataract surgery rate in Chinese than in Malays and Indians) may account for the data observed. The Medisave coverage may be dissimilar between the racial groups.
with higher coverage for the Chinese, compared with Indians and Malays. However, we believe this to be unlikely as coverage is almost universal and there are clear financial incentives for everybody to participate and use the Medisave scheme.

Finally, by cautiously extrapolating our findings to the populations in China, India, and Indonesia15 (the 3 largest countries in Asia), we project an annual number of RD operations of approximately 142,000 in China, 36,000 in India, and 12,000 in Indonesia. The design and implementation of appropriate eye care delivery systems in Asia to manage this level of illness needs urgent attention.

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This study was approved by the institutional review boards of the Singapore National Eye Center and Johns Hopkins University School of Hygiene and Public Health.

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