Epidemiology in Practice: Screening for Eye Disease

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Introduction

In the belief that 'prevention is better than cure' there has been widespread enthusiasm for screening populations for illness in its early stage, so that a better outcome can be achieved by more effective intervention. This concept has grown in strength in western populations because of the increasing importance of cancer as a major cause of death. Cancer with its insidious course and natural history which moves from a localised and treatable phase to a widespread and untreatable one is an example of a group of conditions for which screening has been believed to be appropriate. But, even in cancer, important lessons have been learnt about the limitations of screening. The only cancer for which screening is widespread in western nations is that of the cervix. There is still controversy as to its effectiveness and meanwhile, breast cancer screening has only been established in a few countries despite evidence that mammography may reduce mortality in certain sections of the population. There are no widespread or national strategies for screening eye conditions in western populations except for the testing of children's vision. This is usually to detect amblyopia at a stage when treatment is thought still to be effective and, thereafter, at school to identify refractive errors. There is a also a general view that it is justified to screen known diabetics for retinopathy, but so far there is no consensus on how it should be done and indeed whether it will be effective in preventing blindness. Studies on both these issues are underway.

Definitions of Screening

There is much confusion over the use of the term 'screening'. Mass screening, opportunistic screening, case finding, screening camps and screening tests are all examples of the growing uncertainty. It is useful to apply strict definitions to the term in order to avoid confusion. Screening is a public health intervention intended to improve the health of a precisely defined target population. Within this population are individuals considered at risk of the effects of a condition, and screening is justified by the awareness of that condition as an important public health problem. It is the anticipated identification of those who may have a problem and who might benefit from further investigation and treatment. It therefore involves the application of a quick and simple test, usually by paramedics, to large numbers of normal persons, so that those with a possible problem can be identified. It does not make the final diagnosis.

The importance of this concept is that screening is never something that should be undertaken casually and it should always be carefully monitored and evaluated. Without strict criteria, monitoring is impossible. 'Opportunistic screening' is a concept and a term which should be avoided. In a few circumstances it might be appropriate to test casually for a condition in a patient who has presented with another unrelated condition, but this should rather be called 'opportunistic surveillance'. Similarly, 'screening camps' are misnamed. The term 'screening' here implies an element of uncertainty which should not be acceptable when patients are being identified as possible candidates for surgery, either at the base hospital – or worse, at the camp itself. The tests at such camps have to be diagnostic and precise. If they are not, the outcome of cataract surgery may be poor due to poor case selection. Finally, the use of the term 'screening test' should only be used when the test is being used to separate one group of patients from another, where the individuals who test positive go on to more precise diagnostic investigations.

Problems with Screening: Coverage

Screening is potentially expensive and it is an intervention which is thrust upon the public rather than a response to an individual seeking help. It must, therefore, be constantly and carefully monitored both for its processes and its effectiveness. **False negative** tests are a constant source of concern and there is often public outrage after such occurrences. **False positive** tests cause undue anxiety and wasted resources. But for the screening programme to be effective, it must reach a high proportion of the population at risk. Failure to achieve this leads to the failure of the programme to meet its targets. This is measured by **coverage** – the proportion of the target population successfully tested in each screening activity. Keep in mind that it is those often hardest to reach in screening programmes who suffer from the worst disease. In diabetes, for example, it is the bilateral amputee or the resentful/indifferent young diabetic who are the least likely to comply with an invitation for an eye examination – and yet they are the most likely to be in need of treatment.

The Screening Test: Validity

The ability of the screening test to differentiate between those who are disease free from those who are affected is called the test **validity**. Here the terms **sensitivity** and **specificity** are used and these are easily confused.

- **Sensitivity** is the proportion of disease positive individuals who are detected by the test and hence reflects the important group who are disease positive but not detected by the test – the 'false negatives'. A useful way to remember this is that the 'N' of false Negatives is in the 'N' of 'seNsitivity'.
- **Specificity** on the other hand is the ability of the test to correctly identify those who do not have the disease, the proportion of disease free people correctly labelled as disease free. Thus, this reflects the important proportion of people said to have the disease when they have not – the false Positives; and again remembered by the 'P' in 'sPecificity'. Further reading in public health texts will deal with these for those interested.

Effectiveness of Screening Programmes: Costs

These are all measures of the process of screening. More important ultimately is evidence of the **effectiveness** of screening, showing that the screening programme succeeds in reducing morbidity, disability or mortality from the target condition. Thus, for cancer screening, it must be shown that the screening intervention reduces death rates from the particular cancer. Screening for lung cancer with mobile chest x-ray units was discontinued because it failed to show any effect on death rates. In modern cost conscious health economies, it is now necessary that the cost of screening can be justified by the health gain achieved. In the case of eyes, this means the number of sight years saved and cutting the social costs of failing to prevent loss of sight. To do this it is necessary to draw up a complex model which shows how the benefits compare with the costs. Such models have been successfully constructed for screening diabetics for retinopathy in fully industrialised economies, and it is on the basis of these models that action is now being taken in the UK to develop national strategies for diabetic screening.

In order to construct such models we need detailed epidemiological information on the prevalence and incidence of the condition, the natural history of the disease (including any differential mortality of those affected), and the effectiveness of treatment. To decide whether the screening will be economically beneficial, it is necessary then to add information on costs of screening, of treatment (including dealing with false positives) and costs of failure to detect and treat. Unfortunately, diabetic eye disease is probably the only ophthalmic condition for which these requirements can be met. Certainly, this is not yet the case for either glaucoma or amblyopia, though much work is ongoing to rectify the situation.

The Future: Screening for Genetic Disease

With the huge growth of the Human Genome Project, a global endeavour to sequence the entire human genetic code, screening is about to enter a new era. The potential to identify carriers of genes which may increase susceptibility to a disease (glaucoma for instance) will attract increasing attention and concern of the public. The need to consider ethical, economic and humanitarian factors will greatly increase, in order to prevent wastage of scarce resources, undue anxiety and the potential stigma associated with identified carriers. Unless there is clear evidence that resources for effective intervention are available for all affected individuals, gene testing should remain in the area of research alone.

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FIVE AGES OF THE SURGEON

1 The trainee wants to be a surgeon: enthusiasm and anxiety

IF ONLY I CAN DO IT!

2 The trainee succeeds; a surgeon is born: the adrenaline flows

I CAN DO IT!!

3 A few years on, "In my hands,success rate of 98%".
The confidence of the experienced surgeon; reluctance to let others do the job not so well:

ONLY I CAN DO IT

Many surgeons do not progress beyond this stage.

4 Then in time, a feeling that something more is needed:

IF ONLY I CAN DO IT . . .

then there is a problem when I'm gone.
Perhaps somebody needs to train a few more surgeons . . .

5 At last the realisation that training is my responsibility.
Seeing the need and being willing to train others.

IF I CAN DO IT, SO CAN YOU!!

The surgeon is 'born again'.

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Abstract

Age over 46 years does not affect the pressure lowering effect of trabeculectomy in primary open angle glaucoma

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Background/aims

Previous reports have suggested that the success rate for trabeculectomy is poorer in younger age groups but these studies often have heterogeneous groups representing different types of glaucoma with variable surgical prognosis. Therefore, the relation between age and the success of trabeculectomy in the single diagnostic category of primary open angle glaucoma (POAG) without identifiable risk factors was examined for failure in the age range 46–85 years.

Methods

The records of 208 patients who had undergone a first trabeculectomy for POAG were examined retrospectively. Age ranged from 46 to 85 (mean 66.7 years). The outcome of surgery was examined at final available follow up and at 1 and 2 years after surgery. Trabeculectomy was considered a success if intraocular pressure was ≤ 21 mm Hg with or without additional medical treatment ('cumulative' success) and an 'absolute' success if intraocular pressure was ≤ 21mm Hg without additional medical treatment.

Results

Cumulative success for trabeculectomy was 92.3% at final follow up and 96.6% at 2 year follow up; absolute success rate was 66.3% at final follow up and 71.6% at 2 years. There was no significant trend for greater success of trabeculectomy in the older age groups (cumulative success at 2 year follow up, χ^2 for linear trend 1.07 (p=0.3) nor was the drop in intraocular pressure following surgery significantly greater with increasing age (analysis of variance for intraocular pressure lowering from presentation to 2 years' follow up (Kruskal-Wallis t=5.9, p=0.55). Patients with pseudoexfoliation were excluded from the main analysis as these patients have been shown to have a lower final intraocular pressure following trabeculectomy, a finding which was confirmed in this study.

Conclusion

This study demonstrates that in the age range 46–85 years there is no demonstrable relation between age at the time of surgery and success of trabeculectomy in POAG.

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