A Critical Review of Periodic Health Screening Using Specific Screening Criteria

Part 1: Selected Diseases of Respiratory, Cardiovascular, and Central Nervous Systems

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Despite the increasing interest in recent years in prevention and early recognition of asymptomatic disease, there has been a lag in development of a sound scientific basis for efforts in this area. No objectively based program for periodic health screening of asymptomatic adults has yet been proposed for the primary care physician. This is the first in a series of four articles which will critically examine the feasibility of screening procedures for 36 selected diseases. Six basic criteria are adopted as necessary to justify periodic screening. Specific screening recommendations are made for each disease, and a longitudinal screening program for asymptomatic adults will be proposed in the concluding article of this series.

One of the primary obligations of family doctors and other primary care physicians is the prevention of disease and early recognition of disease states in the hopes of preventing or minimizing subsequent complications. However, the question, "What health examinations or tests should be done, at what intervals, on which asymptomatic patients?" remains unanswered.

Periodic health screening programs proliferated after World War II. These were often financed by large industries and populations screened were often executives. Many studies reported a high rate of disease detection among these asymptomatic persons.[1,2,3] However, critical analysis revealed several problems: (1) Many of the diseases detected were chronic conditions whose course was not changed by early detection;[4] (2) Many of the initial abnormalities were not confirmed on follow-up;[5] (3) A large number of patients did not receive follow-up;[6] and (4) The programs were frequently one-time screening efforts with very few patients receiving longitudinal "periodic examination."[1,7]

In reviewing the literature it became apparent that no scientifically based program for periodic health screening had yet been proposed for use in the primary physician's office. Even with the advent of the automated multiphasic testing center[8,9] and the concepts of health hazard appraisal and risk factor analysis[10,11] the question, "Does periodic health screening improve health or decrease morbidity and mortality?" remained unanswered.[12-17]

We feel it is important for family physicians to think in terms of selective screening and longitudinal risk factor analysis. This requires extensive knowledge of a large number of diseases. This information is widely scattered in numerous publications, is often controversial, and a substantial amount is unknown. The purpose of this series of articles is to assemble and condense as much of this information as possible, and use it to construct a longitudinal screening program or "life flow sheet" for *asymptomatic adult patients* in our own model family practice unit. Several other life flow sheets have already been published[18] but none have included the data and rationale behind each recommendation. This series specifically includes a discussion of the rationale for each recommended screening test. Furthermore, it provides an extensive bibliography so that the reader may critically reevaluate each area and reach his own conclusions.

Methods

The following criteria are generally deemed necessary to justify screening for a given disease:

1. The disease must have a significant effect on quality or quantity of life.
2. Acceptable methods of treatment must be available.
3. The disease must have an asymptomatic period during which detection and treatment significantly reduce morbidity and/or mortality.
4. Treatment in the asymptomatic phase must yield a therapeutic result superior to that obtained by delaying treatment until symptoms appear.
5. Tests must be available at reasonable cost to detect the condition in

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the asymptomatic period.
6. The incidence of the condition must be sufficient to justify the cost of screening.

Using the "Geller Tables,"[19] American Cancer Society statistics,[20] and other sources, we tabulated a list of 36 diseases which were then evaluated according to the above criteria. We arbitrarily considered only diseases affecting adults. The following facts about each disease were specifically sought:

1. Incidence and prevalence of the disease, age and sex-specific if possible.
2. Progression of the disease both with and without treatment, to include morbidity, mortality, and the length of the early asymptomatic period.
3. Risk factors associated with development of the disease.
4. Availability of screening tests, their safety, sensitivity and specificity in the early stages of the disease and their unit cost.

A brief discussion of each disease was then formulated and conclusions were made regarding the suitability and type of screening to be done. Finally, these recommendations were combined into a longitudinal screening program.

This article, as the first in a four-part series, will deal with nine major disorders relating to the respiratory, cardiovascular and central nervous systems. The prevalence of these diseases is shown in Table 1. In the last article of this series, a longitudinal screening program will be proposed based upon the six basic criteria which we have adopted to justify screening in asymptomatic adults.

Table 1. Selected Diseases of Respiratory, Cardiovascular and Central Nervous Systems

Disease	Occurrence per 100,000	
Smoking	35,000	(P)
Hypertension	15,000	(P)
Ischemic Heart Disease	2,800	(P)
Rheumatic Heart Disease	170	(P)
Stroke	102	(DR)
Tuberculosis	80	(P)
Lung Cancer	26	(I)
Brain Tumors	12	(I)
Chronic Obstructive Pulmonary Disease*	10.6	(DR)

I = Incidence P = Prevalence DR = Death Rate

*The relative prevalence of these diseases is probably understated in this table due to difficulties in determining true prevalence rates.

Smoking

Smoking may not necessarily be considered a disease, but it represents a significant health hazard and merits individual consideration in a screening program.

Occurrence:

Thirty-five percent of the adult population consumes tobacco on a regular basis. Below age 12 less than five percent of males and less than one percent of females smoke. Subsequently, there is a regular increase in prevalence, such that 40 to 55 percent of high school seniors smoke. By age 25, approximately 60 percent of men and 36 percent of women smoke. The prevalence continues to increase up to age 35 to 40. Thereafter, it drops to approximately 20 percent of men and four percent of women aged 65 or over.[21] Known risk factors which contribute to the development of smoking habits include male sex, lower socioeconomic class, urban locale, religious belief, and, perhaps most important, the parents' smoking habits.

Progression:

Cigarette smoking is associated with an average 70 percent increase in age-specific mortality rates.[22] In general, the greater the number of cigarettes smoked per day, the higher the mortality. Smokers of less than ten cigarettes per day have a death rate 40 percent higher than nonsmokers; this steadily increases to the point where smokers of greater than 40 cigarettes per day have a death rate 120 percent higher than nonsmokers.[22] Mortality increases with the duration of smoking habit and with the amount of smoke inhaled. The death rate for men smoking less than five *cigars* per day is approximately the same as for nonsmokers. Death rates for pipe smokers are little, if at all, higher than for nonsmokers.

Smokers have 1.7 times the mortality from coronary heart disease as nonsmokers. In males aged 45 to 64 who smoke greater than 40 cigarettes per day, this ratio climbs to approximately 3.4.[22] Between ages 45 and 74, death rates from *cerebrovascular disease* are 37 to 50 percent higher in male smokers than nonsmokers, and 38 to 111 percent higher in female smokers than nonsmokers.[22] Mortality rates from *aortic aneurysm* in 2.12 to 7.26, depending on the amount smoked.[22]

The relationship between cigarette smoking and *chronic bronchopulmonary disease* is striking. Mortality ratios for smokers compared to nonsmokers vary from 4.6 for those who smoke one to nine cigarettes per day, to 18.2 for those who smoke greater than 40 cigarettes per day. Cigarette smokers consistently have more symptoms of cough, secretion production, wheezing and shortness of breath than nonsmokers.[22] The most impressive statistical relationship of all exists between cigarette smoking and *lung cancer*. In one study, the mortality ratio of smokers compared to nonsmokers for males aged 55 to 64 was 7.0 for smokers of one to nine cigarettes per day, to 33.8 for smokers of greater than 40 cigarettes per day! Degree of inhalation and duration of lifetime smoking history also positively affected mortality ratios from lung cancer.[22]

Treatment:

Smoking is a sociocultural phenomenon whose cure is difficult. Therapeutic success is dependent on motivation, and no data exists on the rate at which smokers convert to nonsmokers under treatment. It has been well demonstrated that discontinuation of smoking does substantially reduce the risk of morbidity and mortality from coronary heart disease, chronic bronchopulmonary diseases, and lung cancer.[22]

Diagnosis:

The diagnosis of smoking by history presents no difficulty except in

young age groups where admitting to a smoking habit might result in punitive repercussions.

Conclusion:

Cigarette smoking is a habit associated with considerable mortality from several diseases. Cessation of smoking does decrease mortality. Although not asymptomatic, its health consequences are often not appreciated by the smoker. We recommend a smoking history be taken initially and repeated at ages 30 and 40.

Hypertension

Occurrence:

The prevalence of hypertension, defined conservatively as a systolic pressure greater than 140 mm Hg or a diastolic pressure greater than 90 mm Hg, is 15 percent of the adult population.[23] Another 15 percent may have borderline hypertension. The prevalence rises slowly until age 60 when it reaches a level of 35 percent of women and 30 percent of men. Blacks are more prone to hypertension than whites and it tends to run in families.

Progression and Benefit from Treatment:

Primary essential hypertension, which constitutes the great majority of cases, usually has a long asymptomatic course.[24] Although asymptomatic itself, it has recently been shown to significantly increase the risk of serious morbidity and mortality from coronary heart disease, cerebrovascular disease, and renal failure.[25-27] Furthermore, adequate treatment of hypertension will reduce the risk of these complications.[26,27] The lag time between the onset of hypertension and development of vascular damage is not precisely known. It is known that the risk of complications increases directly with both the degree and duration of hypertension.[25-27]

Diagnosis:

The mercury sphygmomanometer is the standard method of diagnosing hypertension.[28] It is a quick, reliable determination as long as the proper size cuff is used. A single screening value should always be confirmed at subsequent times before a definite diagnosis is made.

Conclusion:

Hypertension meets all the criteria to warrant periodic screening. Furthermore, it is a major risk factor of two of today's biggest killers, ischemic heart disease and stroke. We recommend that all adults have their blood pressure checked every two years. This frequency is somewhat arbitrary but is based on evidence that the vascular damage is proportionate to the degree and duration of hypertension.

Ischemic Heart Disease

Occurrence:

The prevalence of ischemic heart disease in the adult population of the United States is 2.8 percent.[29] Another 2.2 percent have borderline or suspect ischemic heart disease,[29] and the death rate from this cause is 354 per 100,000 population.[30] The prevalence increases with age from 400 per 100,000 for persons aged 25 to 34, to 15,400 for those 65 to 74.[30] Men are affected three times as frequently as women.[30]

Many risk factors for the development of ischemic heart disease have been identified. The major ones, hypertension, hyperlipidemia and smoking[30-31] are of enough importance that we have considered them at greater length in individual sections of this report. Other risk factors include diabetes mellitus, hyperuricemia, obesity, sedentary lifestyle, psychosocial tension, and family history of ischemic heart disease.[30-31]

Progression and Benefit from Treatment:

The exact nature and duration of the presymptomatic phase of ischemic heart disease is not known. It is felt that the atherosclerotic process can start very early in life especially if risk factors are present. The initial presentation of this disease is myocardial infarction (45 percent), angina pectoris (23 percent), sudden death (11 percent) or the incidental diagnosis in the asymptomatic person (16 percent).[32] Other data indicate the incidence of sudden death is 25 percent with an additional ten percent of those suffering myocardial infarction dying within weeks of the first attack.[30] Once ischemic heart disease is manifest, patients have a fivefold increased risk of dying within five years from this cause.[30]

There are three phases in the treatment of ischemic heart disease: (1) the prevention of atherosclerosis, (2) the reversal of existing atherosclerosis, and (3) management of acute coronary attacks and subsequent complications. The third of these does not concern us here because by definition it occurs in acutely symptomatic persons.

The prevention of atherosclerosis is done by reducing amenable risk factors including hypertension, hyperlipidemia, smoking and obesity.[30] The reversibility of established atherosclerosis by reduction of risk factors is more controversial. Studies have shown that dietary reduction of calories, fat and cholesterol in coronary prone men reduced the incidence of coronary attacks. The reduction in death rate was not statistically significant due to the small population size.[30] Likewise, ex-smokers have an intermediate incidence of coronary attacks between smokers and nonsmokers.[30] Treatment of hypertension does decrease the incidence of coronary attacks but not as dramatically as it reduces the incidence of congestive heart failure and stroke.[30]

Long-term, large-scale studies will be necessary before a final statement is made on the reversibility of atherosclerosis by risk factor reduction. The initial evidence indicates minimizing risk factors is worthwhile.

One final way of treating localized atherosclerosis is coronary artery bypass surgery. This is a newer technique and the long term results are not known. It is not presently indicated in asymptomatic persons.[33]

Diagnosis:

Methods of diagnosing ischemic heart disease in asymptomatic persons include physical examination, chest x-ray, resting electrocardiogram, exercise electrocardiogram, and coronary arteriography.

The physical exam and chest x-ray are poor methods of detecting early disease since they will only pick up signs of secondary cardiac decompensation. Only eight percent of patients with ischemic heart disease are diagnosed by physical examination and four percent by chest x-ray.[34]

Confusion arises when discussing the diagnostic accuracy of the ECG because in many cases the presence of ischemic heart disease is defined by abnormalities of this test. Phillips reported that 65 percent of patients with heart disease were detected by a 12 lead cardiogram.[34] However, in an 18-year follow-up from the Framingham study only 27 percent of patients suffering myocardial infarctions had had previously abnormal cardiograms.[35] The ECG was normal in 73 percent of these patients with ischemic heart disease until the time of their infarction, so that the resting cardiogram is not a sensitive test for this disease. It will only detect between one quarter to two thirds of patients with early disease. Since the ECG is often used to define heart disease, the rate of false positives is difficult to determine.

The post-exercise ECG is more sensitive than the resting ECG in detecting ischemic heart disease. Masters reports only three percent false negatives and 3.8 percent false positive tests in 800 persons, using eight years of clinical and ECG follow-up as his criteria for the diagnosis. It is also more costly and time-consuming than a resting ECG.

Cardiac catheterization is too costly and risky to be considered as a screening procedure.

Conclusion:

The only specific treatment for ischemic heart disease, excluding coronary bypass surgery, is the identification and elimination of risk factors to prevent and hopefully reverse atherosclerosis formation. Therefore, we recommend screening for hypertension every two years, determining cholesterol every four years, screening by history for smoking every ten years, and checking for obesity every four to six years; once identified, maximal efforts should be made to normalize these parameters.

We do not recommend use of the cardiogram as a routine screen because the finding of an abnormality does not lead to any new method of treatment. Treatment is still the reduction of risk factors. Also, the cardiogram is not sensitive and a false reassurance may be implied by a normal result. The post-exercise cardiogram has the same limitation of not leading to a new treatment modality.

Rheumatic Heart Disease (RHD)

Occurrence:

The prevalence of rheumatic fever and rheumatic heart disease is decreasing in the United States. In 1960, one percent of the adult population had RHD.[37] In 1970, a study of Denver schoolchildren showed a prevalence of RHD of 170 per 100,000 and a history of rheumatic fever in 1,280 per 100,000 children.[38] The prevalence increases with age, reflecting more RHD in persons who grew up during the pre-antibiotic era.

Progression and Benefit from Treatment:

Primary rheumatic fever is a disease of children, new cases are unusual after age 25 and recurrences are rare after age 30.[39] About ten percent of children with rheumatic fever will develop RHD.[38] The severity of the chronic valvular disease increases with successive recurrences of rheumatic fever.[40] Patients with RHD are susceptible to bacterial endocarditis throughout their lives – ten percent of adults dying with RHD can be shown to have subacute bacterial endocarditis.[41]

Treatment of adults with RHD has three phases: continuous antibiotic prophylaxis to prevent recurrence in young adults, intermittent prophylaxis during "at risk" times to prevent endocarditis, and medical and surgical treatment of symptomatic valvular disease. There is considerable debate concerning the age to which continuous penicillin prophylaxis should be continued,[42,43] but it is effective in preventing recurrences of rheumatic fever.[44] Likewise, intermittent prophylaxis will effectively decrease the incidence of bacterial endocarditis.[45]

Diagnosis:

The diagnosis of RHD and past rheumatic fever is made by history and physical examination. The ECG does not improve screening for this disease.[38]

Conclusion:

Unrecognized RHD and past rheumatic fever exposes the asymptomatic adult to significant morbidity from recurrences of rheumatic fever and subacute bacterial endocarditis. Appropriate treatment with antibiotic prophylaxis can reduce this risk. Since most of the primary disease occurs in childhood, we recommend a single screen of adults when first seen or at age 21 by complete cardiovascular history and physical examination.

Stroke

Occurrence:

The death rate from cerebrovascular disease is 102.6 per 100,000 population.[20] Seventy-five percent of strokes are caused by cerebral infarction secondary to thrombosis, while 15 percent are caused by intracranial and subarachnoid hemorrhage.[46] The disease is most common in persons over 55. The incidence is one percent per year in persons 65 to 74 and two percent per year in those over 75.[46] Risk factors include hypertension, elevated serum lipids and diabetes. Males are affected more frequently than females.

Progression and Benefit from Treatment:

The onset of stroke is frequently a sudden catastrophic event; however, one third of ischemic stroke victims have had previous transient ischemic attacks with subsequent recovery.[46] Eighty percent of patients with ischemic stroke survive the acute episode compared to 20 to 40 percent of patients suffering a cerebral hemorrhage. The overall five-year survival is 50 percent.

Treatment of strokes has several components. The treatment of hypertension has been shown to decrease the subsequent incidence of stroke.[26,27] Elevated serum cholesterol is a definite risk factor but its treatment has not yet been proven to decrease the incidence of subsequent cerebrovascular accidents.

Surgical correction of extracranial arterial stenosis has recently been studied in a large cooperative study. The long-term results are still under investigation but indications are that some subgroups of stroke patients with transient ischemic attacks may benefit from surgery. The surgical mortality and morbidity in this series was 11.4 percent.[47] Surgery is not recommended for asymptomatic patients. Anticoagulant therapy has been shown to be beneficial in patients with transient ischemic attacks or evolving strokes.[46]

Diagnosis:

Stroke is diagnosed by history and physical examination at the time of the acute episode. Suspicion of stroke potential may be indicated earlier by carotid bruits or other signs of cerebrovascular insufficiency. However, there is no good way of predicting stroke victims in advance of symptoms.

Conclusion:

The only treatment for stroke in the asymptomatic stage is the reduction of risk factors. We recommend screening adults for hypertension every two years. We also recommend screening for hypercholesterolemia, although this is primarily done to prevent heart disease. No other specific screening for stroke is indicated.

Tuberculosis

Occurrence:

The estimated prevalence of active tuberculosis in the United States is 80 per 100,000. Another 70 per 100,000 have inactive T.b.[48] Seventeen percent of the population have positive tuberculin skin tests.[49] The incidence of T.b. varies greatly by geographic area. It is more common in deprived areas, urban areas, among men and among nonwhites. A recent study in a Long Island suburb showed an overall incidence of new cases of active T.b. of 12.6 per 100,000. However, the incidence in poverty areas was 26.4 per 100,000 and among nonwhites was 93.2 per 100,000.[50] The incidence of active T.b. in adults rises steadily with increasing age.[51]

Progression and Benefit from Treatment:

The epidemiology of T.b. has changed drastically since the advent of antituberculous drugs in the late 1940's and early 1950's. Whereas formerly 70 percent of children age 14 had positive tuberculin tests, a 1964 study found only 2.2 percent of 14 year old children with positive tests.[52] Many adults now have negative tuberculin tests and when exposed are infected for the first time. Furthermore, adult primary (or first infection) T.b. is often anatomically indistinguishable from secondary T.b. rather than following the more benign course of "classical primary" or childhood T.b.[53] Persons with a positive P.P.D. have a five percent chance of developing active T.b. and are a definite high risk group.[52] Untreated active T.b. causes considerable morbidity and mortality. Clinical symptoms such as cough, sputum production, and fever may be present but as many as 75 percent of patients with active disease may be asymptomatic.[54] Medical treatment will effectively arrest or cure tuberculosis in the individual patient. This is evidenced by the declining death rate from T.b. from 50 per 100,000 in 1935, to less than five per 100,000 today.[50,51]

Diagnosis:

The tuberculin skin test using five tuberculin P.P.D. becomes positive from two to ten weeks after a primary tuberculosis infection. It usually remains positive for life unless the patient is treated early with antituberculous drugs.[55] It is 90 percent sensitive for active disease[56] but does not distinguish between active and latent or inactive disease. Thus, it is useful only as a screen to identify the population at high risk of developing active disease. These people must then be followed by other means. False negatives may be caused by severe illness, measles, smallpox, sarcoidosis, steroid therapy, or overwhelming T.b.[57]

The chest x-ray has been widely used in the past for mass screening for T.b. It has been phased out, however, because of a declining yield of new cases. In 1958, the yield was zero to three new cases per 1,000 x-rays.[58] It remains, however, a highly sensitive method of detecting individual cases of T.b.

Sputum examination is not used as a screening method for T.b. because of the difficulty of collection and processing.

Conclusion:

Tuberculosis is a common disease with significant morbidity which is frequently asymptomatic. We recommend screening by tuberculin testing initially and subsequently every ten years. Specific high risk populations need to be screened more frequently. Once identified, the tuberculosis positive individual must be further evaluated and often treated. That discussion, however, is beyond the scope of this paper.

Lung Cancer

Occurrence:

The annual female death rate from lung cancer is eight per 100,000. For males the rate is 45 per 100,000.[59] The incidence of lung cancer shows a recent upward trend, especially in men. There is a strong relationship between patient age and incidence of lung cancer. For males at age 30 the prevalence is one per 100,000, by age 40 it reaches ten per 100,000, and by age 65 it reaches a peak of 150 per 100,000. For females the prevalence is 0.4 per 100,000 at age 30 and rises less rapidly to four per 100,000 at age 45, reaching a peak of about 20 per 100,000 at age 65 to 70.[22]

Male sex, increasing age, cigarette smoking, asbestosis, and other pneumoconiosis are recognized risk factors. Furthermore, there is a relationship between the duration of smoking, daily consumption, amount inhaled, and the risk of developing lung cancer.[22]

Progression:

Lung cancer is a rapidly growing neoplasm with a short asymptomatic period. When detected it is usually unresectable and pursues a rapidly fatal course.[60] The average survival from time of diagnosis is six to nine months.[61]

In one large study with chest x-rays every six months all lung cancers found developed in smokers. Fifty-eight percent of cancers developed in people with chronic chest x-ray abnormalities. Interestingly, 90 percent of new cancers were symptomatic prior to the onset of radiographic changes.[62] Thus, the latent period between onset of signs and incurability is probably less than six months.

Benefit from Treatment:

The only hope of cure is surgery and surgical success is directly related to the stage of the disease. Surgical resection is a high risk procedure with a mortality of three to 14 percent.[63] The five-year survival is only 10.5 to 23.7 percent in those who originally qualified as surgical candidates.[63] Boucot's series demonstrates that early diagnosis and surgery only raises overall five-year survival from zero to between five to eight percent.[62]

Diagnosis:

The most common screening tech-

nique for lung cancer is the chest x-ray. Early radiologic signs are subtle and often missed by expert pulmonary radiologists.[64] One third of lesions arise centrally and are incurable before being evident on x-ray.[62] The yield of positive tumors is low especially on repeat exams (one per 6,937).[65] Finally, even with x-ray screening every six months the five-year survival is only five to eight percent.[62]

Sputum cytology with multiple specimens is positive in 75 percent of cases of lung cancer.[61] In central lesions it will often be positive prior to x-ray changes. The ability of cytologic screening to improve mortality has not been shown.

Conclusions:

Lung cancer is a common disease with a rapidly fatal course. No screening is recommended because with present techniques attempts at early diagnosis do not significantly decrease mortality. (Fails criteria 2,5)

Primary Intracranial Neoplasms

Occurrence:

The annual incidence of primary brain tumors is about 12 per 100,000. It increases with age; at ages zero to 24 it is 3.9 per 100,000, it climbs to 18.9 per 100,000 at ages 45 to 64, over age 65 it rises to 69 per 100,000. Peak incidence is in the fifth and sixth decades. There is no sex predilection.[66]

Progression and Benefit from Treatment:

The term primary intracranial neoplasm encompasses many different entities with distinct presentations, natural histories, and prognoses. Forty-three percent are gliomas of which more than 50 percent are glioblastomas, 15 percent are meningiomas, 13 percent are acoustic neurinomas, and 6.5 percent are pituitary adenomas.[67] In general, the results of treatment are good in the last three groups, which are slow growing lesions often having a long symptomatic period prior to diagnosis and treatment. The results are poorer in the first group which tends to have a much shorter time course and is less amenable to complete surgical cure. Treatment is usually surgical (except for pituitary adenomas); and in general, only 40 percent of patients can be restored to useful life while another 30 percent gain good palliation.[68]

Diagnosis:

Brain tumors present in a great variety of ways depending on type and location. Symptoms frequently antedate all other findings.[69] Physical signs, while often present early in the disease, may not develop until late. Papilledema, which is 90 percent sensitive for brain tumors, is a late sign of the disease. Skull films are only positive in 25 percent of cases.[70] Brain scans, while safe, and although they are 80 to 90 percent sensitive and more than 99 percent specific,[71] cost at least $100 and are thus very expensive. The electroencephalogram costs at least $45 and takes approximately one hour of time to complete. It is abnormal in about 75 percent of cases, and the abnormality is well localized in about 40 percent of cases.[68] Lumbar puncture reveals elevated protein or pressure in about 70 percent of cases, but can be hazardous in presence of elevated CSF pressure.[69] Air contrast studies and angiography are too expensive and hazardous for routine use.

Conclusion:

Primary intracranial tumors are uncommon. Treatment is risky and results are generally poor, except in those slow growing lesions which present with symptoms for a long time. Manifestations of these tumors are highly variable; no single test is safe, sensitive, specific, and inexpensive enough to be used for screening. We, therefore, recommend no screening be done for these diseases. (Fails criterion 5)

Chronic Obstructive Pulmonary Disease (COPD)

Occurrence:

The definition and criteria for the diagnosis of chronic bronchitis and emphysema are not ideal for determining prevalence in the general population. The absence of standard diagnostic methods has resulted in the use of signs and symptoms to determine prevalence.[72] The prevalence of symptoms in various surveys varies tremendously.[72] It is thus impossible to deduce the precise prevalence of COPD in the adult population. One can only say it is common. The death rate for COPD is 10.6 per 100,000. For males ages 25 to 34 it is 0.3 per 100,000 and rises to 50.3 per 100,000 for men 55 to 64. It continues to rise in subsequent decades. For females ages 25 to 34 the death rate is 0.2 per 100,000 and rises progressively to 25.3 per 100,000 at ages 75 to 84.[22] Increasing age, male sex, exposure to air pollution, occupational exposure to dust and other pollutants, smoking, especially cigarettes, and a homozygous and perhaps heterozygous form of alpha-1 antitrypsin deficiency are recognized risk factors for developing COPD.

Progression and Benefit from Treatment:

COPD is a chronic, progressive disease. Little is known about its preclinical course. Conclusions regarding the time course of morbidity and mortality once the disease is clinically manifest are extremely varied. In Burrows' study[73] of serial pulmonary function tests in symptomatic patients with COPD, he shows a regular, predictable yearly deterioration in pulmonary function despite treatment. The gross five-year survival was only about 50 percent. In contrast, Brinkman and Block found the morbidity and mortality from COPD to be very low.[74]

Although aggressive treatment reduces mortality and morbidity from acute exacerbations of COPD, no one has shown that the cronic use of expectorants, antibiotics, bronchodilators, or inhalation therapy arrests the progressive deterioration of pulmonary function associated with the disease. In fact, the relief of symptoms is the indication for these modes of therapy.[75] In the asymptomatic stage, the only "therapy" is avoidance of smoking and minimizing exposure to dusts and other air pollutants.

Diagnosis:

There are three possible ways of diagnosing asymptomatic COPD. Physical examination is frequently normal in the early stages in both forms of COPD. The chest x-ray is also a poor screening device for the early stages of COPD. Most patients with chronic bronchitis will show a normal chest roentgenogram and only one third to one half of cases of mild to moderately severe emphysema will be

diagnosed on chest x-ray. Chest x-ray, therefore, is not a sensitive indicator of early COPD.

Pulmonary Function testing is a standard method for quantitating the severity of COPD. However, its specificity in early asymptomatic disease is not known. In an asymptomatic population 1.9 percent had pulmonary function abnormalities.[77] The proportion of these individuals who will develop clinically significant COPD and the degree of reversibility of the process at this stage is unknown.

Conclusion:

COPD is a common disease with significant morbidity. The only treatment in the asymptomatic stage is avoidance of smoking and other pulmonary irritants. Therefore, no specific screening for COPD is justified. We do recommend screening for smoking as previously discussed. (Fails criteria 3 and 4)

Discussion

We have attempted to strictly require that all criteria were fulfilled before recommending any particular screening test. Failing a single criterion was enough to disqualify a test or disease from screening. This is perhaps more rigid than many of us are in practice but was necessary to avoid the pitfall of being carried away by intuition, special interest group propaganda, "common practice," and personal emotional bias. Therefore, many commonly used reasons for doing screening tests such as: "The test has a high yield," "It is so easy to do," or "It's good to have a baseline value," were not sufficient.

It should also be emphasized that we are considering screening only the hypothetical *completely asymptomatic person.* This does not imply that the screening test is a sufficient workup for the disease being screened once detected or that incidental symptoms should not be evaluated.

In an area as controversial as health screening, many people will undoubtedly disagree with some of our conclusions. This is good if it leads to further discussion of the issues and objectively based arguments and experimentation. We have purposely included a large bibliography referencing as much of the data on which our conclusions are based as possible so the reader can explore any area in greater depth.

We feel that health screening programs must be objectively based. As Cochrane has stated, "There is an ethical difference between everyday medical practice and screening. If a patient asks a medical practitioner for help, the doctor does the best he can. He is not responsible for defects of medical knowledge. If, however, the practitioner initiates screening procedures, he is in a very different situation. He should, in our view, have conclusive evidence that screening can alter the natural history of disease in a significant proportion of those screened."[12]

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