preparation to demonstrate at least one form of supersensitivity, that due to loss of neuronal uptake and confined to agonists subject to neuronal uptake. This is so; the noradrenaline supersensitivity produced by cocaine, 6-hydroxydopamine or some neurone blocking drugs does not extend to either oxymetazoline, which is not subject to neuronal uptake, or to carbachol[18]. Two other forms of supersensitivity have been demonstrated by the same workers. First is a non-selective increase in sensitivity produced by chronic reserpine or thyroxine treatment which causes a supersensitivity to acetylcholine and KCl as well as to noradrenaline, a situation similar to that produced by chronic denervation in other tissues. The mechanism here, as in other tissues, is obscure. Second, an increase in the maximum contractile response with no change in the dose–percentage response is produced by morphine withdrawal, by single doses of reserpine or by corticosterone. The common link in these apparently dissimilar situations may be an increase in plasma corticosterone since the supersensitivity following morphine withdrawal or reserpine is absent when steroid synthesis is inhibited by metyrapone or when the adrenals have been removed, and the mechanism may be to alter the tissue distribution of sodium since either blocking the sodium–potassium pump with ouabain or raising extracellular sodium levels will similarly raise the maximum response. In addition to these major forms of drug supersensitivity other minor effects have been reported. Morphine withdrawal causes some hypersensitivity to ACh apparently from inhibition of cholinesterase by corticosterone and an even more puzzling observation is a specific hypersensitivity to ACh produced by the antidepressant mianserin.

In conclusion, the years since its introduction seem to confirm the anococcygeus as a useful preparation for both teaching and research. So far its usefulness has been mainly in the study of adrenergic neurotransmission. This situation will surely be transformed when more is known of the inhibitory nerves and transmitter.

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The clinician's role in patient compliance

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A large number of therapies are currently available which, when used in accordance with the established details of the regimen, are reasonably efficacious in preventing and treating illness. However, as the focus of medical practice has shifted from acute illnesses to chronic diseases, patients can no longer be only passive recipients of medical care, but instead, must take an active role in managing their own care (with physician guidance). Thus progress in treatment and in achievement of desired medical outcomes depends heavily upon patient adherence (or 'compliance') to recommended or prescribed regimens.

An extensive literature exists documenting generally low rates of patient compliance. Although these rates vary for different conditions, treatments, patients, and settings, reviewers have noted that at least a third of the patients in most studies failed to co-operate with their physicians' advice. Moreover, when the medication regimen is long term, only about 50% of patients are generally found to be compliant, and this figure can drop to 25% or lower where the condition is asymptomatic (as, for example, is frequently the case with a medication regimen for hypertension)[19]. Other research efforts have clearly demonstrated that physicians cannot predict the probable degree of their patients' adherence to regimen at levels of accuracy better than would be attained by chance; moreover, they substantially *overestimate* the compliance rates of their own patients, and often express both little desire to understand the problem and little sympathy for the unco-operative patient (although, as medical students, their own drug-taking behaviors and compliance-related attitudes closely mirror those found for patients in general).

Noncompliance creates significant barriers to attainment of therapeutic goals: by disrupting or invalidating the potential benefits of the regimen, by exposing the patient to additional medical tests and alternative therapies which may be duplicative or unnecessary, and which may result in iatrogenic outcomes, by interfering with the doctor-patient relationship (e.g. patient dissatisfaction resulting from poor medical outcomes caused by poor compliance, and negative reactions by physicians to 'problem' patients) and by interfering with attempts to evaluate the quality of the treatment.

A considerable amount of the research on noncompliance has examined the role of the patient's sociodemographic characteristics (e.g. age, sex, religion, race, mari-

tal status, income, and education). This approach has yielded a multiplicity of inconsistent results, the majority of which were not related to co-operation with therapy[9]. The single consistent finding seems to be that both noncompliance and medication errors are often associated with extremes of age, perhaps because the very young are most resistant to ingesting bad-tasting medicine and because geriatric patients more often experience problems of forgetfulness or self-neglect. Additional research, regarding personality traits of the patient (e.g. illness dependency, authoritarianism, and frustration tolerance), has failed to produce findings linking these factors with compliance (since physicians frequently assert that the patient's personality is a major reason for lack of co-operation, it is interesting to note this lack of correlation, in the research literature, between personality dimensions and adherence).

Providing information

Investigations of the usefulness of providing various kinds of information to the patient have revealed a number of important considerations which influence the likelihood of patient compliance. First, patient recall declines rapidly; five minutes after meeting with the physician, about half of the instructions are forgotten[15]. The patient remembers best what occured during the first one-third of the interaction, and recollection is better concerning the diagnosis than for the prescribed therapy[14]. Second, the provision of general information about matters other than the regimen (e.g. about the illness, how the medicine works) does not appear to increase the likelihood of adherence[11]. Third, *many* patients do not understand many of the most common medical terms (e.g. 'work-up', 'incubation period', 'void', 'water retention')[12,16]. These findings suggest that, in communicating with the patient, the physician be brief and selective, emphasizing informational elements necessary for compliance clearly and early in the communication, and providing recall-assisting redundancy through repetition, both orally and through simple written instruction to which the patient may later refer (a combination of oral and written instructions results in the highest levels of patient information-retention).

Changing aspects of the regimen

Studies show that compliance levels increase with decreases in the treatment plan's complexity, duration, requirements for alterations in life style, inconvenience and cost[1,17]. Different investigations have demonstrated the compliance-enhancing efficacy of: (1) simplifying the regimen by reducing the number of daily administrations and/or different medications by utilizing, if clinically acceptable, fewer but larger doses, pharmaceuticals designed for once-a-day oral administration and combinations of single tablets; by synchronizing doses; and by avoiding the *routine* prescription of additional medications (especially over-the-counter drugs) not essential to the treatment[17], (2) altering critical behaviors one at a time, thus enabling the patient to build up to the prescribed regimen repertoire[6], (3) 'tailoring' or linking the medication schedule to the patient's regular daily activities, thus increasing its convenience and making it more difficult to forget[20], and (4) reducing the regimen's cost to the patient by prescribing generically, avoiding unnecessary or over-the-counter prescribing and so forth.

Altering patient's health beliefs

A large body of research has concluded that a patient's beliefs about his health, about his particular illness and about the prescribed treatment, have a strong influence on the probability of his compliance with the regimen[2]. Evidence points to the particular importance of the patient's: (1) *health motivation*: degree of interest in, and concern about, health matters in general, (2) *susceptibility*: perceptions of vulnerability (or *re*susceptibility) to the particular illness (or to its sequelae), including acceptance of the practitioner's diagnosis, (3) *severity*: perceptions concerning the probable seriousness of the consequences, on both bodily and social dimensions, of contracting the illness or of leaving it untreated and (4) *benefits and costs*: an evaluation of the advocated health behavior in terms of its probable effectiveness in preventing or treating the condition, weighed against estimates of various barriers which might be involved in undertaking the recommended action (e.g. financial expense, physical and/or emotional discomfort, inconvenience, possibility of adverse side effects, etc.).

Data emphasizing the importance of these health beliefs are available from studies of patient cooperation with many different types of recommended therapies, from participation in screening and weight loss programs to compliance with different short and long-run medication regimens[2,4,6,18]. Research has demonstrated these attitudes and perceptions to be alterable; by learning which of these beliefs are below a level presumed necessary for compliance, the physician can plan his intervention to meet the unique needs of each patient. Thus, it is recommended that greater attention be given both to monitoring and to motivating the patient along these belief dimensions (e.g. does the patient: care about health; agree with the diagnosis; perceive the condition as very serious, or not at all serious; feel the recommended therapy will work; fear medication side effects; feel the regimen will be too hard to follow?). The taking of such a 'compliance-oriented history' should be seen as a critical extension of the usual medical history, and be made a routine part of the examination process.

The variety of belief-change strategies which may be employed is limited only by the physician's ingenuity. Sometimes merely providing corrective factual information will prove sufficient; in other cases, more extensive discussion, motive-arousing appeals (e.g. fear, parental or family responsibility, pride), recommendations from other sources of information viewed by the patient as having greater credibility (e.g. another patient for whom the same treatment was successful), and other interventions will be necessary.

An example detailing the positive effects on patient compliance of physician awareness of the patient's health beliefs can be found in a controlled trial by Inui *et al.*[10] One of two groups of physicians was given special tutorials (1–2 h in length) whose content emphasized both compliance difficulties experienced by patients with hypertension and possible strategies for altering patients' beliefs and behaviors (based on the belief dimensions described above). After only a single session, physicians in the experimental group were observed to spend a greater proportion of clinic-visit time on patient teaching, and their patients later exhibited higher levels of knowledge and appropriate beliefs about hypertension and its treatment. Moreover, the patients of tutored physicians were subsequently more compliant with the treatment regimen and demonstrated better blood pressure control.

Doctor-patient interaction

Numerous aspects of the contemporary clinician-patient interaction (such as impersonality and brevity of encounter) can have a negative effect on patient behavior. Lack of 'communication' (particularly of an emotional nature) is often the problem. Davis[8] found that 'patterns of communication which deviate from the normative doctor-patient relationship will be associated with patients' failure to comply with doctors' advice'; such deviations include circumstances where tension in the interaction is not released, and where the

physician is formal, rejecting, controlling, disagrees completely with the patient, or interviews the patient at length without subsequent feedback. Francis and others[7] report that a mother's compliance with a regimen prescribed for her child is better when she is satisfied with the initial contact, perceives the physician as friendly, and feels that the doctor understood the complaint; further, they found that 'the extent to which patients' expectations from the medical visit were left unmet, lack of warmth in the doctor-patient relation, and failure to receive an explanation of diagnosis and cause of the child's illness were key factors in noncompliance'.

Many other investigations have also shown compliance to be related to the patient's satisfaction with the visit, the therapist, or the clinic, including his perceptions of convenience and of waiting times before and during appointments. Adherence is greater where the patient feels that his expectations have been fulfilled; where the provider elicits and respects all of the patient's concerns and provides responsive information to the patient about his condition and progress; and where sincere concern and sympathy are shown[8].

Another important dimension of the patient-therapist interaction is the degree of supervision encountered. A variety of 'before-after' studies have demonstrated increased patient co-operation when: frequency of outpatient visits is increased, home visits are added, patients receive negative feedback concerning their noncompliance and patients receive continuity of care[9]. Techniques may be devised to extend supervision beyond the patient's time at the office or health facility, for example, by reminder calls concerning the regimen and/or the follow-up visit, by requesting that pill bottles be brought to the next visit, by asking the patient to keep a record of when (and how many) pills were taken each day.

A relatively recent development which attempts to capitalize upon (and in some ways, improve) the relationship between provider and patient is the 'therapeutic contract', wherein both parties set forth a treatment goal, the specific obligations of each party in attempting to achieve that goal, and a time limit for its achievement[10]. Data are now available in support of the provider-client contract as a tool for increasing patient compliance.

Enlisting family support

The patient's family is an important potential mechanism for reminding, assisting, encouraging, and reinforcing the patient with respect to following medical advice. Social support is especially critical in the case of long-term treatment plans which require continuous action on the part of the patient[5]. For example, in studies of weight control, investigators have found that those persons who received assistance from another family member in cueing or reinforcement of proper eating behavior were more likely to lose weight and to maintain that weight loss; similar outcomes have been described for the family's influence on compliance with recommendations for obtaining immunizations and other preventive measures, and for taking medications. Many studies of family-level variables have documented relationships between extent of patient compliance and family members', (1) assumption of responsibility for the sick member's care, (2) evaluation of the illness and the recommended treatment, (3) health beliefs, (4) sympathy, support and encouragement, (5) compatibility of normal roles and patterns with the patient's sick role or regimen and (6) willingness to engage in making changes in the environment[1].

The family can, of course, exert a negative as well as a positive impact on a member's willingness to initiate or continue care; thus, the practitioner should be encouraged to cautiously evaluate the role of the family in the patient's therapy program, and to attempt to both maximize its potential constructive contributions and minimize its possible destructive influences.

Summary

This article has briefly summarized the results of a wide variety of studies on the determinants of patient compliance. On the basis of these findings, we would recommend that the physician concerned with increasing the likelihood of his patients' co-operation with therapies should try, whenever possible, to: (1) improve patients' knowledge concerning the *specifics* of their regimens, reinforcing essential points with review, discussion and clearly-written instruction and emphasizing the importance of the therapeutic plan, (2) take clinically-appropriate steps to reduce the cost, complexity, duration, and amount of behavioral change required by the regimen and to increase the regimen's convenience (through tailoring etc.), (3) obtain a 'compliance-oriented history' of the patient's prior experiences and present health beliefs, and, where necessary, employ strategies to modify those perceptions likely to inhibit compliance, (4) improve levels of patient satisfaction, particularly with the provider-patient relationship; encourage (and reply to) questions concerning the diagnosis and proposed therapy, (5) arrange for the continued monitoring of the patient's subsequent compliance to treatment (e.g. establish specific follow-up appointments, arrange for reminder telephone checks and ask the patient to call if there are any problems) and (6) create mechanisms for supervising the patient (including, where appropriate, further involvement of the patient's social support network).

Hopefully, while more research on determinants of patient co-operation and on methods for increasing adherence to regimens is still needed, the suggestions offered here can provide the foundation for a rational program which may be implemented by health care practitioners to improve patient compliance

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