

Changes in presence of a segmental dysfunction pattern associated with hypertension: Part 2. A long-term longitudinal study

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The short-term portion of this study (part 1) showed an association between somatic dysfunction and the regulation of blood pressure. To study long-term relationships, follow-up examinations were made of 61 subjects studied 3 to 10 years earlier. They were heterogeneous Family Practice Clinic patients with a mean age of 45 years. By methods used in part 1 and in our previous studies of systemic interactions, palpatory examination was done to support presence or absence of a C6T2T6 pattern of segmental motion dysfunctions, and blood pressure status was established by the medical history. The C6T2T6 pattern persisted in 16 of 16 subjects with grade 2 or greater hypertension and 4 of 9 normotensive subjects who had shown the pattern initially. At follow-up, the pattern first appeared in 7 subjects who had hypertension previously diagnosed and who remained hypertensive; the pattern disappeared in 5 normotensive subjects who remained normotensive. The C6T2T6 pattern's long-term persistence in hypertensive subjects and changes in its presence corresponding to the subjects' hypertensive status

indicate an important relationship between this pattern of segmental motion dysfunctions and disturbances in regulation of blood pressure.

(Key words: Somatic dysfunction, high blood pressure, hypertension, motion asymmetry, segmental dysfunction, functional assessment, segmental motion dysfunction, mirror-image motion asymmetries)

Earlier studies¹⁻⁴ have identified a statistically significant association of a C6T2T6 pattern of segmental motion dysfunctions with established hypertension. To see if this pattern's persistence is a factor related to the development of hypertension, we have reexamined subjects from studies conducted 3 to 10 years earlier using the same standardized procedures as in the earlier studies. The new data regarding association are provided by changes in presence of the pattern coinciding with developing disturbance in regulation of blood pressure. Early evidence of disturbance in regulation of blood pressure is important, particularly in hypertension, because its early stages may be reversible.^{5(pp1-11)}

The literature on interaction between the somatic and cardiovascular systems is lengthy and includes many basic and clinical research fields. The influence of physical activity and muscle fatigue on cardiovascular performance and the mechanisms that adjust blood supply to active muscle are well understood.⁶ Also, a 1992 symposium on somatovisceral interactions included a report on cardiovascular performance.⁷ The influence of stress, stress adapta-

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tion, and individuals' behavioral characteristics that are suspected influences in development of hypertension has been reviewed by Dworkin.⁸

Osteopathic theory on interactions between somatic and visceral systems has been supported in basic research.⁹ Both somato-visceral and viscerosomatic reflexes have been investigated. This basic research identified an altered processing of nervous transmission in the spinal cord in the presence of palpatory tissue texture changes overlying the spinous process and adjacent muscles at a dysfunctional vertebral segment.¹⁰ The role of the spinal cord in processing nerve impulse transmission has been investigated by Patterson.¹¹

Our previous cross-sectional study and the current longitudinal studies raise several questions. Why do some subjects have the C6T2T6 segmental dysfunction pattern but not elevated blood pressure? Why do other subjects lack the pattern in the presence of diagnosed hypertension grade 1 labile or grade 2 and higher? The purpose of the current study was to provide longer-term data on changes in the presence of the C6T2T6 pattern of segmental motion dysfunctions, for comparison with data from the concurrent short-term study reported in part 1 of this article.⁴

Methods

Study subjects

Sixty-one subjects for this long-term study were volunteers who had been examined once during our previous studies at the Chicago College of Osteopathic Medicine (CCOM) Clinics.^{3,12} Follow-up had not been planned as part of their initial participation. They were located through clinic, hospital, and CCOM records (A.F.K.). Contacts by letter, telephone, and interview were used to recruit these former subjects for a follow-up examination.

Table 1
Interaction Between C6T2T6 Segmental Motion Dysfunction Pattern and Regulation of Blood Pressure: Follow-up Examinations After 3 to 10 Years (n=61)

C6T2T6 pattern	Blood pressure status		
	Hypertensive		Normotensive
	≥Grade 2	Labile/grade 1	
Persists X-X	16*	...	4*
Absent O-O	1*	1*	23
Varies O-X	3*	4†	4*
X-O	...	...	5‡

Key:
X-X = C6T2T6 pattern present at initial and follow-up examinations.
O-O = C6T2T6 pattern absent at initial and follow-up examinations.
O-X = C6T2T6 pattern absent at initial examination but present at follow-up examination.
X-O = C6T2T6 pattern present at initial examination but absent at follow-up examination.
* No change in blood pressure status at follow-up examination.
†Hypertension progressed; required medical management.
‡Normotension; pattern disappeared in interim.

Data collection

Baseline data were obtained from studies begun in 1976³ and 1980,¹² and unpublished data from a study in 1983. A single follow-up examination occurred after an interval of 3 to 10 years, and was planned for completion during the 8-month period of the short-term study. Data from subjects' medical chart review and interview provide information similar to that obtained in the short-term study, to include major incidents of illness, surgery, and accidents.⁴

After recruitment, the subjects were processed for examination in the same manner as in the short-term study.⁴ Research records, blinding of the examiner, and the procedures for determining the presence of the pattern were consistent throughout. A subject's blood pressure status was determined from the initial-entry research record. On follow-up visit, the interval history documented any change in status. American Heart Association standards for hypertension were used throughout the longitudinal study; grade 2 and greater hypertension was confirmed by consultation with specialists.

The palpatory data collection has been previously detailed.⁴ Briefly, palpatory procedures were used for segmental examination of the spinal region from C5 to T7. C6, T2, and T6 and their adjacent segments were examined for asymmetric responses to three motion tests: passive lateral translation

Table 2
Change in C6T2T6 Pattern With Respect to
Illness or Accidents in Hypertensive
(≥Grade 2) Returnees in Whom Pattern Was
Present on Initial Examination (n=16)

Change in C6T2T6 pattern	Change in health status*	
	Yes	No
Yes (X-O)	0	0
No (X-X)	6	10

Key:
X-O = C6T2T6 pattern present at initial examination but
absent at follow-up examination.
X-X = C6T2T6 pattern present at initial and follow-up
examinations.
*Change in health status included major incidents of illness,
surgery, or accident.

right versus left; passive translation anterior versus posterior; and active respiration, inhalation versus exhalation. A positive result required rapid development of increasing resistance to initial onset of one direction of a motion test when compared with response to the opposing direction. A standardized format was used to record 27 decisions (three motion tests at nine spinal segments).²⁻⁴ Greater than 23 positive findings were required to establish presence of the C6T2T6 pattern.^{3(p835)}

Data tabulation and analysis

The tabulation of data for the long-term changes in pattern presence and hypertensive status is consistent with that in the short-term study.⁴ Data from the 61 subjects in the long-term study were not analyzed statistically, however, because the sample was too small, and the probability of confounding variables in descriptive research dictated against drawing statistical inferences. Clinical data, however, were used to examine possible factors associated with change in the C6T2T6 pattern's presence, as well as its persistence. These factors include hypertensive status, antihypertensive medications, and interim illness or accidents.

Results

The sample was from a diverse population of former clinic patients that included some former students and faculty members. The 61 subjects' ages ranged from 23 to 77 years, with the mean, 45 years.

The reexamination followed an interval of 3 to 10 years. *Table 1* shows the presence (X) or

absence (O) of the C6T2T6 pattern at the initial and follow-up examinations. The pattern persisted (X-X) in 16 of 16 subjects with grade 2 or greater hypertension on original examination who remained hypertensive at follow-up. It also persisted in 4 of 9 originally normotensive subjects, all of whom remained normotensive.

On the follow-up examination, the C6T2T6 pattern had disappeared (X-O) in 5 normotensive subjects who had remained normotensive. Among those 36 subjects in whom the pattern was not present on initial examination (O-X and O-O), the pattern appeared on follow-up (O-X) in the following: 3 of 4 subjects with hypertension grade 2 or greater; 4 of 27 normotensive subjects; and 4 of 5 with borderline hypertension, all 5 of whom had become hypertensive in the interval, requiring medical control.

As indicated in *Table 2*, there were no changes in presence of the pattern (X-O) attributable to major illness or injury. Of the 61 returnees, there were 16 subjects with grade 2 or greater hypertension who had shown the C6T2T6 pattern at the initial examination. Of those 16 returnees, the C6T2T6 pattern did not change in the 6 who had a major change in health status in the interval.

Discussion

The 80% persistence of the C6T2T6 pattern in subjects with hypertension grade 2 or greater in the longer period strongly supports the 60% to 80% association observed in our previous cross-sectional studies¹⁻³ and short-term longitudinal study reported in part 1 of this paper.⁴ The pattern's presence does not appear to be influenced by antihypertensive medication or by major incidents of illness, surgery, or accident.

Disturbances in regulation of blood pressure can be transient or slowly or rapidly progressive.^{5(pp54-105)} Physical signs are known to appear during subclinical conditions and be absent during obvious illness. Our concurrent short-term study of the association in the variables, pattern and hypertension, might not detect changes in association over the study period of 4 to 8 months. The follow-up examination of 61 subjects from research studies conducted 3 to 10 years earlier provides data involving a longer period.

Most C6T2T6 pattern changes that occurred in the longer interim between the initial and follow-up examination support an association between the presence of the pattern and devel-

opment of hypertension. The C6T2T6 pattern appears for the first time in the follow-up examination of three subjects with grade 2 or greater hypertension, as well as in four subjects with labile/grade 1 hypertension whose hypertension had progressed in the interim to grade 2 or greater, requiring medical control. The C6T2T6 pattern that was present at the initial examination disappeared in the interim in five normotensive subjects.

The other long-term changes in the association of the C6T2T6 pattern and hypertension are difficult to analyze because there are too few cases. The pattern appears in three subjects with grade 2 or greater hypertension only at the second examination. Further, one subject with established hypertension did not exhibit the C6T2T6 pattern at either examination.

Evidence from both the short- and long-term parts of this longitudinal study supports association between the two variables: the C6T2T6 segmental motion dysfunction pattern and hypertension. The nature of the relationship suggests influence(s) common to the control or regulation (or both) of both systems, somatic and cardiovascular, rather than a direct cause/effect. The few cases of persistence or changes in presence of the C6T2T6 pattern for which there is no evidence of relationship need further consideration (Kelso AL and Johnston WL, unpublished data).

Comment

We interpret the persistence of the C6T2T6 pattern of segmental motion dysfunctions in hypertensive subjects for a 3- to -10 year period as support for interaction between the somatic and cardiovascular systems. Some disturbing conditions within the body are common to both those two systems.

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