

Feeling The Pulse

Trial to assess agreement level among TCM students when identifying basic pulse characteristics

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Abstract

This paper reports a study designed to investigate the agreement between TCM students in their discrimination of basic pulse parameters such as speed, depth, volume, length and overall quality of the pulse. Method: a standardised form was used to assess agreement among the sample of students on three occasions: at the beginning of formal pulse diagnosis teaching classes (week 1), at the conclusion of pulse teaching (week 14), and one year later. Students were randomly divided into two groups, with each group randomly assigned three subjects, for whom each member of the group was required to palpate the pulse. Data were analysed using Chi square (χ^2 , $\alpha = 0.05$). Results and conclusions: Results indicated that participants' estimations of a subject's pulse were influenced by the subject's gender, the types of pulse characteristic measured, and radial pulse position. While the results indicated a significant level of difference in agreement for some pulse characteristics, the overall level of agreement was not different from that expected by chance alone. It is likely that the problems in pulse quality evaluation recognition do not stem from the ability of the student to learn to use pulse diagnosis reliably, but rather, from inadequacies in the relevant pulse literature and conflicting information available for the study, teaching and clinical practice of pulse diagnosis.

Key words

Pulse diagnosis, pulse characteristics, traditional Chinese medicine

Introduction

Within the context of traditional Chinese medicine (TCM), pulse diagnosis is a skill developed by traditional Chinese medicine (TCM) practitioners to interpret the varying sensations of the arterial pulses in relation to health and disease. TCM pulse diagnosis focuses upon several pulse characteristics, such as depth, strength, length, speed, rhythm, width and pulse contour. Combinations of these basic characteristics form the foundation of more complex approaches to TCM pulse diagnosis, for example, in describing the overall pulse quality. The inherent assumption of pulse diagnosis is the ability of the pulse to reflect and to change with the state of health of the body. For example, if the liver is inflamed or the spleen hypo-functioning, the subsequent changes in the haemodynamics of the arterial system would be reflected in the associated quality at each radial pulse position. It is this assumed ability that makes pulse diagnosis an important component in the treatment approach to presenting pathological conditions in clinical practice. However, there is a considerable gap between the theoretical framework of pulse diagnosis and application and the testing of the underlying assumptions. For example, there has been little empirical evidence reported that either supports or refutes the notion that changes in the organ system are reflected in pulse qualities detected at the associated radial arterial pulse positions. Further, and perhaps more importantly, there are no data available that demonstrate whether practitioners can reliably and consistently discern these changes. Clearly this skill is essential for the use of the radial pulse in clinical practice: unless there is reliable interpretation of pulse types between practitioners, the diagnostic technique is of little practical use.

Pulse diagnosis is often described as the most important of the four diagnostic examinations used in TCM and considered necessary for pattern diagnosis (Kaptchuk, 1983). This view has been supported by the findings of recent surveys of final year TCM students at two Australian universities, in which respondents emphasised the importance they placed on pulse diagnosis in their clinical practice (Smith, 1996). However, a central problem that remains for this diagnostic technique is its highly subjective nature and the limited availability of research studies to substantiate the reliability of the pulse method. For example, studies by Kass (1990) and Craddock (1996) reported that the consistency, both within and between practitioners in relation to their measurement and evaluation of certain pulse characteristics,

participants' estimations of a subject's pulse were influenced by the subject's gender, the types of pulse characteristic measured, and radial pulse position

decreased with increasing pulse complexity.

In spite of limited sample sizes, both studies have clear implications for the teaching and study of pulse diagnosis. The present study was undertaken in order to investigate pulse discrimination skills of TCM students in their evaluation of basic pulse characteristics. An advantage of using TCM student participants who were all enrolled in the same TCM study programme was that initially, the teaching and information of pulse definitions was standardised for all participants in the study. This minimised divergence between students in relation to their pulse education, training or experience.

In the study, student pulse discrimination skills were examined at three stages in the progress of the cohort of TCM undergraduate students through their course (Bachelor of Health Sciences (Acupuncture) at the University of Technology, Sydney (UTS)). These occurred at week 1, the beginning of formal pulse diagnosis classes (collection 1), at the conclusion of 14 weeks of pulse taking classes (collection 2)

and again one year later when the participants had completed a further 12 months of their course and clinical studies (collection 3).

Method

For all three data collections, the same experimental procedure, pulse reporting questionnaire and study room set up were used. In each, volunteer student participants palpated the radial pulse of three volunteer subjects and recorded their interpretation of specific pulse characteristics on a standardised form. The definitions of the pulse characteristics covered in the assessment form are summarised below.

Speed – this has three basic subdivisions: fast (>90 beats per minute (bpm), normal (between 60 and 90 bpm) and slow (< 60 bpm). Students were asked to rank their assessment of the pulse rate on a scale of 1-7, where 1 is fast and 7 is slow.

Depth – has three subdivisions: superficial, middle and deep. The superficial level is located by lightly placing the finger on the skin without pressure. Deep is found at the level of the bone and is usually found in a healthy person by first occluding the artery and slightly raising the fingers. The middle depth is less objective and found somewhere between superficial and deep. The depth of the pulse is defined by both the detection or lack of the pulse at a particular level and the degree of strength presenting at that level. The depth of the pulse was evaluated at the *cun*, *guan* and *chi* positions.

Strength – this is defined as the force of the pulsation hitting the palpating finger or the rate of pressure rise over time during systole. Strength can be described in terms of full (replete) and empty (vacuous), where empty refers to a pulse easily occluded with finger pressure and lacking strength (or a small pressure/time ratio) and full refers to a pulse that presents with resistance to finger pressure (or a large pressure/time ratio).

Length – the practitioner palpates for the presence, or lack of, arterial pulsations beyond the *cun*, *guan* and *chi* positions. Pulsations beyond *cun* and *chi* are classified as long while a pulse that presents with pulsations only at one or two positions is classified as short.

Subjects

The subjects comprised the volunteers whose pulses were palpated. Six different volunteers acted as subjects for each of the data collections. Due to time constraints for each collection period, it was not possible to have all participants palpate the pulse of the same three subjects; therefore, two parallel experimental groups were used for each collection. The six subjects were randomly assigned to either group 1 (subjects 1, 2 and 3) or group 2 (subjects 4, 5 and 6).

All subjects were positioned behind screens before participants arrived and were requested not to consume substances such as coffee and alcohol either for at least one hour before commencement of data collection or during the course of each collection.

Participants

The participants were the students who palpated the pulses of the subjects. Initially, these comprised volunteer TCM acupuncture students who were undertaking their second year of studies in the UTS acupuncture course for the first and second collection and, subsequently, in their third year of the programme for the third collection. The group of students was selected since they were about to commence formal pulse instruction classes the week after collection 1.

TCM theory assumes that characteristics such as body type, personality and facial features reflect both the relative health of an individual as well as pathological processes present. The latter are assumed to be reflected in an individual's pulse. Therefore, the student participants were blinded to the identity and appearance of the subjects.

Procedure

Each respective data collection was conducted over a period of two to three hours and between 9 am and 12 noon. All collections were completed in the same location, with similar environmental conditions. All subjects were requested to refrain from speaking during the collection. Participants were handed the pulse assessment forms prior to entering the room and any questions about the form were answered at this point. Once in the room, participants were randomly assigned to one of two groups (group 1 or group 2) and were randomly allocated the order in which they would palpate the pulses of the three subjects allocated to their respectively assigned groups. The random order of presentation was intended to distribute the effects of time tied factors such as practice and fatigue.

Subjects were seated at padded tables, totally screened by curtains from the participants. They were requested to remain in a relaxed but upright position to help minimise changes in the pulse quality that might occur. The table height was adjusted so that the subjects' arms were level with the heart when placed flat upon the surface of the table. In order to palpate the subjects' pulses, the participants were seated opposite each subject in turn and extended their hands through the curtain screen and located the subject's radial artery and the associated pulses, using the styloid process as a guide. Subjects were asked to accommodate this by placing their arms in a comfortable and accessible position but one that did not expose their arms or hands to the participants. During the collection period, the pulse rate for each subject was taken at intervals by one of the research team and recorded. This provided an objective measure of speed and a check on whether the pulse rate remained constant.

Data Analysis

No attempt was made to define the 'correct' response for any of the pulse qualities manifested in any subject. This was not the aim of the present study. Analyses were designed to determine where the level of agreement concerning pulse discrimination among participants with the same subject differs significantly from that predicted by chance alone. For exam-

ple, the quality 'depth' had three possible significant values: deep, middle and superficial. Based on chance alone it would be predicted that one third of participants would select each of the three possible alternatives for a subject's pulse. If one of the values (for example, deep) was selected by a significantly greater proportion of participants, then it could be assumed that factors other than chance were involved (for example, that in fact that a subjects' pulse exhibited characteristics that could be interpreted as 'deep').

There are several limitations of this assumption that relate to the selection of the 'normal' value (that is, neither deep nor superficial). On one hand, selection of 'normal' may reflect a participant's inability to discriminate the quality of depth, even when values 'deep' or 'superficial' are pre-

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sent. Alternatively, given the normal health status of the subjects, it is possible that, for many qualities, the values would not be extreme and that 'normal' would be the appropriate value.

For each of the pulse qualities assessed (excluding speed and overall quality), participants were asked to select, as their answer, one of the options given on the standardised assessment form. For each characteristic, data were analysed using Chi square (χ^2) to determine whether the level of agreement among participants differed significantly from that predicted by chance alone. The level of significance was set at the standard value of $\alpha = 0.05$. The analyses of the 12 pulse characteristics were completed to determine whether pulse characteristics discrimination by participants was affected by:

- a) collection phase,
- b) gender of the subject,
- c) pulse characteristic.

Results

There were three subjects per strand and two strands per collection with 12 pulse characteristics discriminated by participants for each subject (excluding speed). This gives a total of 72 characteristics observed for each collection. For collection 1, participants showed a level of pulse discrimination that differed from that expected by chance alone for 25 of the observed data sets. These results form the basis for the level of pulse discrimination skills brought into the pulse taking classes by the students. For collection 2 (week 14: conclusion of formal pulse teaching classes), 31 of the 72 sets of data had a level of pulse discrimination different from that expected by chance, while for collection 3 (one year later), 17 of the 72 sets of data showed significant discrimination differences. The level of agreement in pulse discrimination was significantly greater than expected by chance for collection 2 ($\alpha = 0.05$, $\chi^2 = 0.046$), while collection 1 and 3 showed no difference from that expected from chance alone. The results are presented in Figure 1.

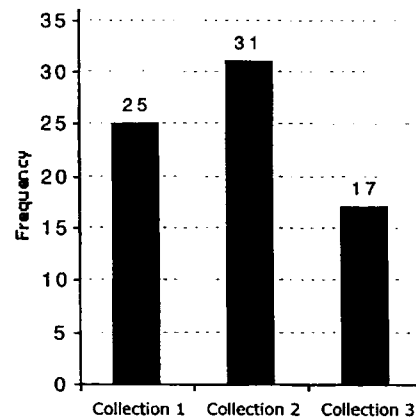


Figure 1. Number of significant pulse discrimination levels for the 72 pulse characteristics by collection phase.

Collection phase and gender

Overall in the collections, participants had more occasions of significant agreement relating to the pulses of female subjects than male subjects. That is, while 44% of the subjects were men, only 30% of agreement related to male subjects. By contrast, 70% of agreement related to the women (who represented 56% of subjects). While there was a trend relating to a subject's gender, overall the difference did not reach statistical significance ($\alpha = 0.05$, $\chi^2 = 0.06$). Results are set out in Figure 2.

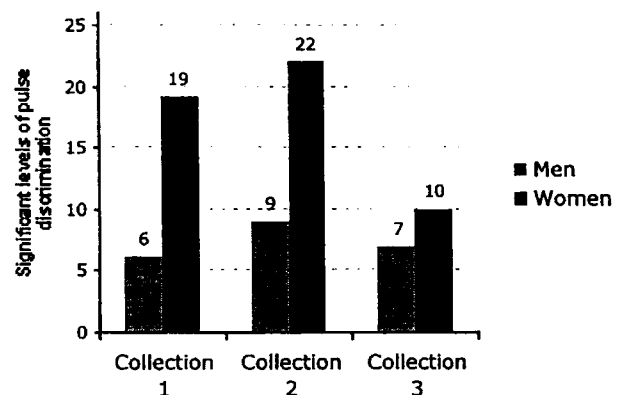


Figure 2. Distribution of significant occasions of pulse discrimination by collection and gender. Note that four subjects in collection 1 were women and only two subjects were men.

Discrimination for individual subjects

Figure 3 shows the number of pulse qualities for which significant discrimination agreement was obtained for each of the subjects in each collection period. Each subject's gender is shown. From Figure 3 it can be seen that levels of agreement were higher for some subjects than others. For example, there were ten qualities for subject 6 in collection 2 for which participants achieved significant levels of pulse discrimination, while there were no qualities for subjects 2, 3 and 4 in collection 3 for which significant agreement was evident.

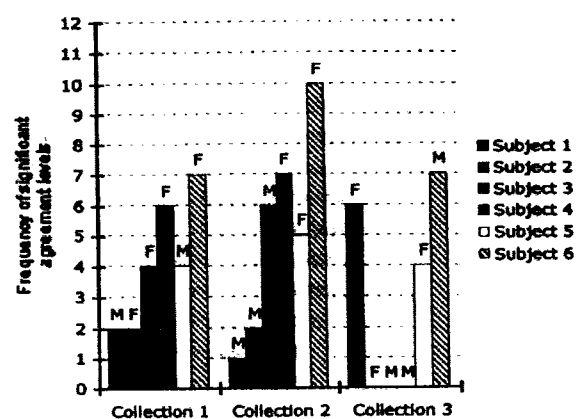


Figure 3. Number of pulse qualities for which significant discrimination agreement was obtained for each of the subjects in the three collection periods.

Pulse discrimination by radial pulse position

A strong relationship between levels of significant pulse discrimination and radial pulse position was evident in the results. That is, the proximal or *chi* positions, recorded the highest levels of significant pulse discernment for the pulse category full/empty (that is strength, exhibited in a subject's pulse), for both the left (61%) and right hands (55%). *Guan*, the middle position, recorded the second highest, while *cun*, the distal position, recorded the fewest levels of significant pulse discernment by participants (see Figure 4).

There was a significant difference in discrimination from that expected by chance between the *cun* and *chi* positions for the pulse characteristic full/empty ($\alpha = 0.05$, $p = 0.026$).

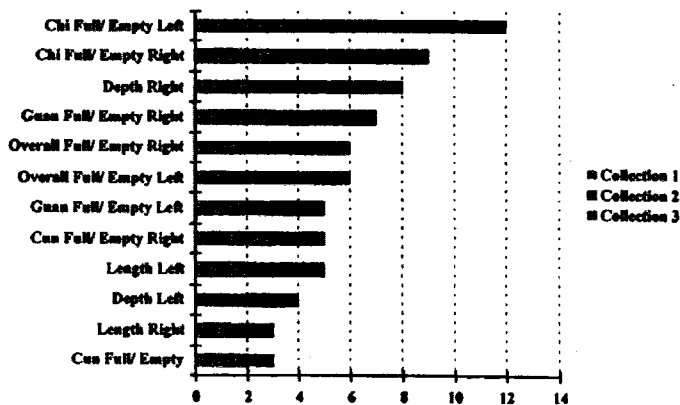


Figure 4: Overall frequency of significant pulse discrimination levels by students for each of the pulse characteristics within each collection. As there were six subjects each collection and a total of three collections, each characteristic occurred a total of 18 times.

Discussion of Results

Levels of agreement for the participants' pulse discrimination skills were obtained on three occasions: at the beginning of pulse diagnosis classes, 14 weeks later at their conclusion and one year later. The results highlighted three factors, quite apart from any distinguishable pulse characteristics present, which appeared to influence a participant's discernment of a subject's pulse. These related to the actual pulse characteristic being assessed, the gender of the subject and the collection phase.

Pulse characteristics

The observed difference in the level of significant pulse discrimination for the pulse characteristic of full/empty between the pulse positions *cun*, *guan* and *chi* was of particular interest. It is likely that these findings may in part be explained by the anatomy of the wrist itself. The *chi* position is located just proximal to the styloid process of the radius. At this position, the artery is located relatively deep in the wrist and as a result, all *chi* categories with significant participant pulse discrimination levels were for participants nominating for a pulse category defined by a small pulse amplitude with respect to time: that is, empty. By contrast, at the *cun* position, the artery is relatively superficial with little tissue covering the pulsations of the arterial wall which possibly make it difficult to distinguish levels of strength. As such, pulse discrimination by participants may have been categorising the strength (empty/full) at each pulse position on relative ease of access rather than actual pulse strength.

Significance levels across subjects

There was a noticeable variation in the level of significant pulse discrimination by participants for particular subjects. This was notable for subjects 3 and 6 in collection 2, and subject 1 in collection 3 (see Figure 3). These three subjects had a relatively high number of pulse characteristics that had significant pulse discrimination by the participants within their

respective groups, while the other subjects in those same groups had very poor levels of agreement by those same student participants. This was likely to reflect the presence of some distinguishing characteristics in the individual's pulse rather than chance alone, since the students were randomly allocated to individual subjects and practice and fatigue effects were thereby controlled.

Gender

Gender of the subject was one subject characteristic related to student participants' pulse discrimination. Although the rates of significant difference based upon gender of the subject did not reach statistical significance level of 0.05, the near significance of the relationship ($p = 0.06$) was unexpected and warrants further investigation of gender and pulse discrimination skills.

A gender difference in radial systolic blood pressure with higher measurements for men has been reported by Asmar *et al* (1997). As the gender mix across the collection phases of the present study was relatively similar, the difference in radial arterial strength between genders could account for the disproportionate levels of significance recorded for female subjects. Possibly a stronger pulse for men might make it harder to distinguish different levels of strength.

Across the collections

A difficulty encountered in the present research stemmed from the decrease in sample size across the three collections. The original group of 35 participating in collection 1 was reduced to 29 by collection 2 and to 20 for collection 3. This could not be avoided since data collection for individual participants was anonymous, and it was not possible to identify responses across collections by individual participants. This prevented both the deletion of data from collection 1 and collection 2 for participants lost to subsequent collection stages, as well as comparisons across the three collection periods. However, all of the participants in collection 3 had participated in the previous two collections.

Another variable that could have influenced the results was the gender balance of subjects in each collection. Four of the six subjects in collection 1 were female, while there was an even gender split for collection 2 and 3. Given the trend towards a greater level of agreement by the participants for pulse characteristic discrimination of female subjects' pulses, the gender difference favouring female subjects in collection 1 may have skewed the interpretation of the results in two ways. First, the actual degree of influence pulse teaching classes had on the students' pulse discrimination and secondly, the level of pulse discrimination skills that the students initially brought to the study.

In spite of an extra year of TCM study, curriculum and clinical study, the lowest levels of pulse discrimination agreement were recorded on collection 3. Particularly concerning is that the pulse characteristics being assessed are part of a group of characteristics that form the foundation of pulse diagnosis in TCM. Since the participants in collection 3 had completed an additional year of their TCM programme, the

results were not expected to show a decrease in significant levels of difference than that obtained in collection 1, even in the absence of continued formal pulse teaching classes. Rather than a gender difference in subject numbers between collection 1 and 3, an alternative explanation for this decline in levels lies in the variety of information available to the students on pulse diagnosis in the literature and in other curriculum subjects. This mainly manifested in the abstract and subjective definitions used for describing possible pulse qualities palpated by the practitioner. Further problems arise from the lack of consistent definitions in the relevant TCM pulse literature. In collections 1 and 2, the participants utilised pulse definitions from a single source within their TCM course; the class notes. By the time of collection 3, a further 12 months of set curriculum and extra curriculum reading of the TCM literature may have contributed to an increased variance in the students' ability to reach consensus in discriminating differences in the pulse. Lack of practice during the additional 12 months is an unlikely explanation since the students use pulse diagnosis in the University's out-patient clinic and other curriculum subjects.

Irrespective of the system of medical practice, problems relating to pulse characteristic definition tend to be inherent within the use of pulse as a diagnostic technique. For example O'Rourke *et al* (1992), in reference to the practice of pulse palpation in western medicine, wrote that ...

'... one can only have pity on our medical students who are instructed at the bedside on the different types of pulse as perceived by different tutors who have completely different standards and use the same antiquated terminology. Perhaps it is best to concede the palpation of the pulse is part of the art, not the science, of medicine' (p.73).

These same problems are deeply entrenched in the TCM establishment and probably to a greater degree than in western medicine for three reasons. The first is a lack of reliable objective recordings of the pulse within TCM diagnostic theory. This means that pulse diagnosis is a subjective process dependent upon the ability of practitioners to identify and

categorise pulse types from a tactile sensation into a communicable form. The second is the inconsistent and sometimes conflicting interpretation and abstract definitions of pulse types in TCM clinical practice. Both authors and practitioners have failed to identify unambiguously what they mean when stating or describing pulse characteristics (Wiseman and Feng, 1999). The third stems from both the lack of questioning, and the ready acceptance, of clinical theory and assumptions as they relate to clinical practice. For example, the assumed 'individuality' of the pulse and the 'changeability' of the pulse from one moment to the next, which surely contradicts the premise of a diagnostic system that assumes consistency to the manifestation of pulse types with certain pathological processes (Schmieder *et al* 1996, Veerman *et al* 1995, O'Rourke *et al* 1992).

Conclusions

In TCM, the pulse continues to represent an important tool in the diagnosis of pathological processes in clinical practice. This study focused upon basic pulse characteristics that form the foundation of more complex approaches to pulse diagnosis and a student's level of pulse discrimination skills in identifying these characteristics before, during and 12 months after formal pulse diagnosis classes. While the gender of the subject, the pulse characteristic being measured and collection phase influenced a student's level of pulse characteristic discrimination, the overall level of agreement was not different than that expected by chance alone. A likely problem in pulse characteristic evaluation lies not from the ability of the student to learn pulse diagnosis, but rather, from inadequacies in the relevant pulse literature leading to conflicting information that impacts upon the study, teaching and ultimately the clinical practice of this diagnostic technique.

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