2008. Vol.29. No.5. 90-95
The Journal of Korean Oriental Medicine

Original Article

A Study about the Correlation of the Angle of Costal Arch with Digestion and BMI

Hee-Seung Lee, Seong-Sik Park

Dept. of Sasang Constitutional Medicine, College of Oriental Medicine, Dongguk University

Objectives : The purpose of this study is to evaluate if there is significant correlations between the angle of costal arch and digestion, and BMI(Body Mass Index).
Methods : To know the correlation between digestion and the angle of costal arch, we hand-measured the angle of costal arch and made questionnaire about digestion. We analysed the data with Pearson product-moment correlation analysis using SPSS 12.0.
Results : There is proportional correlation between the angle of costal arch and digestion. Also wider costal arch shows better appetite, faster speed of eating and more quantity of meal. And someone having wider costal arch has less digestion disorder after eating heavy foods or being anxious. And there is proportional relation between angle of the angle of costal arch and BMI.
Conclusions : There is significant correlation between the angle of costal arch and digestion as wider costal arch can digest better. Also it has proportional relation between the angle of costal arch and BMI. We expect that further study about morphology of abdomen will develop our abdominal examination and diagnostic methods.

Key Words : angle of costal arch, costal arch, digestion, BMI.

Introduction

Anatomically the costal arch is the front arch supported on the medial margin of costal cartilages of 7^{th}~10^{th} ribs[1]. The angle of costal arch determines the general shape of a trunk and a capacity of upper abdomen. For this reason, we suppose that there is significant relation between outlook of abdomen and digestion. Bigger capacity of upper abdomen is able to be expected to digest food better. For the last many millenium, we tried to understand our physiology or pathology on the analogy of our body from outlooks. So abdominal examination is commonly used by most of doctors especially to check general condition as well as abdominal problem. Abdominal examination is one of the special ways of diagnosis in Korean medicine therefore we have tried to develope the way to examine abdomen for the last many centuries[2-4]. So to study and to get object data about the angle of costal arch will be meaningful to find a way to diagnose by abdominal examination.

This article evaluate the correlation between costal arch and not only digestion but also BMI(Body Mass Index). We assumed BMI would have proportional relation with costal arch because wider costal arch make bigger abdominal space so that it would help digestion.

• Received : 5 September 2008 • Revised : 4 November 2008 • Accepted : 6 November 2008
• Correspondence to : Seong-Sik Park
Department of Sasang Constitutional Medicine, Dongguk Univ. Oriental Medical Hospital, 87-2, Sunae-dong, Bundang-gu, Seongnam-si, Kyunggi, Korea.
Tel : +82-31-710-3723, Fax : +82-31-710-3780, E-mail : parkss@dongguk.ac.kr

Table 1. Age Distribution of 121 Participants who were Measured The Angle of Costal Arch and Participated to Questionnaire about Digestion (N=number)

age	≤ 19 N	20 ~ 39 N	40 ~ 59 N	≥ 60 N	total N
Male	0	23(19.0%)	17(14.0%)	7(5.8%)	47(38.8%)
Female	5(4.1%)	32(26.4%)	34(28.1%)	3(2.5%)	74(61.2%)
total	5(4.1%)	55(45.5%)	51(42.1%)	10(8.3%)	121(100.0%)

To study correlation between costal arch and digestion we used questionnaire consisted of 11 questions about digestion.

There are several articles written about costal arch and abdominal examination or digestions but none of them were about clinical study or record[5-9].

Therefore the clinical records about the angle of costal arch and the correlation with digestion and BMI are analyzed in this article so that this can be another meaningful way to examine abdomen to diagnose and understand our body.

Methods

1. Subjects

To get the data of correlation between costal arch and digestion, 121 patients participated to answer questionnaires about their digestion and measured the angle of costal arch. The average age of all the patients is 40.01 years and there are 47 men and 74 women(Table 1).

2. Experimental Procedures

(1) How to research data

Angles of costal arch of all the patients were hand measured by graduator(Fig. 1, Kawasa, Japan) with face up lied position.

The center of graduator was put on the end of xiphoid process and we measured the angle between medial margins of costal cartilage. To find medial margins of costal cartilage, we palpated near by costal arch and put the graduator to be parallel to medial margins of costal cartilage(Fig. 2). As far as we know, there was not any special method to measure the angle of costal arch and many variations on shapes of costal arch existed, we only measured the general angle of costal arch.

The questionnaire about digestion which were participated by 121 participants is consisted of 11 questions asking about quantity of each meal, appetites, speed of having meal, if they have meal regularly, if they can skip a meal without difficulty, digestion, tendency to have stomachache, digestion disorder by cold foods, heavy foods, common cold

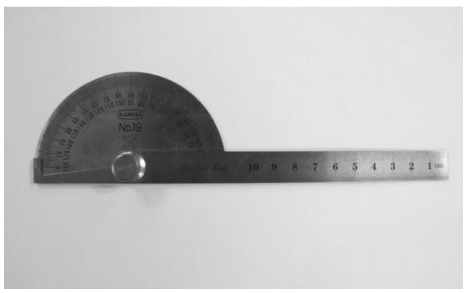

Fig. 1. The graduator to measure the angle of costal arch

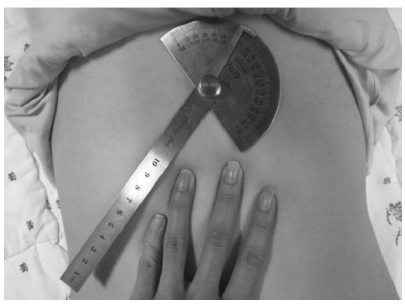

Fig. 2. The angle was measured between medial margins of costal cartilage after palpating the arch.

or anxiety. The answer was chosen one of 5 examples of each question as “never or not at all”, “rare”, “so-so”, “often” and “absolutely or always”.

(2) Statistical Analysis

We analysed the data using SPSS 12.0 for windows. The answers of the digestion questions are numbered to input as to take statistic results. “Never or not at all” is 1, “rare” is 2, “so-so” is 3, “often” is 4 and “absolutely or always” is 5. We analysed the data with Pearson product-moment correlation analysis using SPSS 12.0.

The assumption is ‘wider costal arch can make digestion better’. Pearson product-moment correlation analysis is used when we want to prove that two parameters have positive or negative linear relationship. To know (1) if they have linear relationship, (2) if they have, toward which direction it would be, (3) and how close relationship they have, correlation coefficient is required. Correlation coefficient is from -1 to +1. If they are not related at all, correlation coefficient would be 0. Pearson product-moment correlation coefficient is one of the most usual one and to get it we run SPSS 12.0 version[10].

Results

1. Analysis of the questionnaire about digestion

The first question is ‘I usually eat a lot of quantity as a meal’. To analyze the data we did Pearson product-moment correlation coefficient analysis about costal arch versus quantity of meal. The correlation between costal arch and quantity of meal has positive linear relationship significantly with correlation coefficient 0.209. Therefore it is considered as true that a person with wider costal arch used to eat more quantity of meal.

The second question is ‘I have strong desire to eat’. As the result says, wider angle of costal arch has positive linear relationship with appetite significantly. Its correlation coefficient is 0.258.

‘I usually eat fast’ is the next question about digestion. As the result shows, a person with wider costal arch used to eat faster than someone with sharper one(correlation coefficient 0.229).

The forth question is ‘I have meal regularly’. But there is no significant correlation between costal arch and regularity of meal. Its correlation coefficient is -0.043.

The fifth question is ‘It is so hard for me to skip one meal’. As the result shows, there is no significant linear relationship between costal arch and endurance to skip a meal(correlaion coefficient -0.140). So even if someone have wider angle of costal arch, they are not expected not to have any difficulty to skip a meal.

‘I can digest well’ is the sixth question about digestion. As we see the result there is obviously significant positive linear relationship between costal arch and digestion(correlation coefficient 0.234). So if someone has wider costal arch, we can suppose he may digest better.

The next question is ‘It is often for me to have stomachache after eat’ and as result says they have no significant relationship(correlaion coefficient -0.148).

The eighth question is ‘I cannot digest when I eat cold foods’. As result says, wider costal arch does not have significant relationship with digestion disorder when someone eats cold foods(correlation coefficient -0.118).

‘I have digestion disorder after having heavy foods containing lots of fat or oil’ is the next question. There is meaningful negative proportion relationship between costal arch and digestion disorder after eating heavy foods(correlation coefficient -0.202). So if someone have wider costal arch, he will have less digestion problem after eating heavy foods.

The tenth question is ‘I usually lose appetite when I am sick as to catch a common cold’. There is not significant relation between costal arch and loss appetite when someone is sick(correlation coefficient -0.158).

The last question about digestion is ‘I have digestion disorder when I am nervous of anxious’.

Table 2. Correlation Coefficient of Costal Arch versus Questions

Questions	Pearson correlation coefficient
I eat a lot of quantity as a meal.	.209*
I have strong desire to eat(appetite).	.258†
I usually eat fast.	.229*
Regularity of meal	-.043
Endurance to skip a meal	-.140
Digestion	.234†
Tendency to have stomachache	-.148
Digestion disorder with cold foods	-.118
Digestion disorder with heavy foods	-.202*
Loss appetite with sickness	-.158
Digestion disorder with anxiety	-.192*

*p<0.05: significantly different from baseline, †p<0.01: significantly different from baseline.

Digestion disorder when someone is anxious or stressed has negative proportion relationship with costal arch having(correlaion coefficient -0.192). So it is considered that wide costal arch persons may have less digestion disorder when they are nervous or stressed(Table 2).

2. Analysis of BMI and the angle of costal arch

To know if there is any relation between BMI and the angle of costal arch, we analyzed 121 patients who had been treated and diagnosed with Sasang constitution. As the results say, there is proportional relationship between BMI and costal arch. So most of people with wider costal arch have fatter body than other one with narrower costal arch. Pearson correlation coefficient is 0.567 with p-value below 0.001.

Eventhough, costal arch has proportional relation with BMI, there are some persons below BMI 20 with wider costal arch than 90 degrees. Considering the standard of under weight, below BMI 19 is necessary to be negotiated especially all the participants whose BMI less than 20 with costal arch wider than 100°(mean + standard deviation). So that we chose below BMI 20 to check if there are some who have wide angle of costal arch with underweight. There is only one of 29 participants below BMI 19 who has 100° of costal arch. Also there are 2 persons with 60 degrees as angle of costal arch among 31 of participants with higher BMI than 25; BMI 25.30 and 27.05 for each.

Discussion

Pearson correlation coefficient analysis is used to analyze correlation between costal arch and digestion. Digestion, appetite, speed of eating meal and quantity of meal have positive proportional relationship with angle of costal arch. But there is no significant correlation between angle of costal arch and regularity of meal, difficulty to skip meal, tendency to have stomachache after eat or digestion disorder after eating cold foods. And there are inverse proportional relationship between angle of costal arch and digestion disorder after eating heavy foods or being anxious. As the result says, a person with wide angle of costal arch can digest well, have more appetite and eat more quantity. Also he eats faster, has less digestion disorder problems after eating heavy foods or being stressed. However he has good appetites usually, we cannot expect that it would be hard for him to lose his appetites when he is sick because there is no significant relation

with costal arch. Also we cannot assume that he will have more tendencies to have stomachache or digestion disorder after eating cold foods.

In case of BMI and angle of costal arch, we found proportional relation between them in general, but there were three exceptions that someone had wide costal arch with small BMI or vice versa. So we can assume that someone has wide costal arch eat more and also digest better so that he could have bigger BMI than others. But there is no study about if there is any change of costal arch as getting older or bigger. So it is necessary to study about the change of costal arch during many years because it is consisted of cartilage which is changeable.

After we got the statistical analysis, it is able to have obvious scheme of the correlation between angle of costal arch and digestion, and between angle of costal arch and BMI. However, the range of costal arch is still broad, so it is not enough to diagnose only with the angle of costal arch. For this reason, we suggest that it is necessary to evaluate further study about measuring methods of costal arch and diagnostic methods about abdominal examinations.

References

1. Korean medical association. Medical Dictionary. 1st edition Academia. Korea, Seoul. 2004. P.401.
2. Shin SS, Park WW. A Study of Abdominal Syndrome in Sanghanlun. Dongguk J. The Institute of Oriental Medicine. 1999;7(2):47-67.
3. Shin SW, Kim JB. A Study on the Diagnostic System in <Shang Han Za Bing Lun>. Korean J. Oriental Medical Pathology. 1998;12(1):1-18.
4. Hong MY, Park SD, Park WH. A Study of Abdominal Syndrome in Jin Kui Yao Lue. Dongguk J. The Institute of Oriental Medicine. 1999;8(1):51-76.
5. Huh MH, Koh BH, Song Il-byung. The Body Measuring Method to Classify Sasang Constitutions. Journal of Sasang Constitutional Medicine. 2002; 14(1)51-66.
6. Huh MH, Koh BH, Song IB. A Study of Morphological Schematization of Sasang Constitution. Journal of Sasang Constitutional Medicine. 1989; 1(1)29-39.
7. Lee JH, Kim JG, Yun CY. The Study on the Historical Expansion Process And the Method of the Abdominal Diagnostics. The Journal of The Korea Institute of Oriental Medical Diagnostics. 2000;4(1)69-81.
8. Park HJ, Lee YS, Park SS. A Comparative Study on the Characteristics (Sweat, Stool, Urine, Digestion) of Soyang-Soeumin and Taeyang-Taeumin in Sasang Constitution. Journal of Sasang Constitutional Medicine. 2006;18(1):107-17.
9. Baek TH, Choi JR, Park SS. A Correlation Research of Digestion According to Sasang Constitution. Journal of Sasang Constitutional Medicine. 2004;16(1):112-9.
10. Lee HS, Lim JH. SPSS 12.0 Manual. Korea, Seoul. 2005.

Questionnaires about digestion

1. I eat a lot of quantity as a meal	① ② ③ ④ ⑤
2. I have strong desire to eat(appetite)	① ② ③ ④ ⑤
3. I usually eat fast	① ② ③ ④ ⑤
4. I have meal regularly	① ② ③ ④ ⑤
5. It is so hard for me to skip one meal	① ② ③ ④ ⑤
6. I can digest well	① ② ③ ④ ⑤
7. It is often for me to have stomachache after eat	① ② ③ ④ ⑤
8. I cannot digest when I eat cold foods	① ② ③ ④ ⑤
9. I have digestion disorder after having heavy foods containing lots of fat or oil	① ② ③ ④ ⑤
10. I usually lose appetite when I am sick as to catch a common cold	① ② ③ ④ ⑤
11. I have digestion disorder when I am nervous of anxious	① ② ③ ④ ⑤

① not at all or never
② rare
③ so-so
④ often
⑤ absolutely or always