

Changes in Chinese patch testing practices over 13 years: Updated cross-sectional survey and possible international implications

Ting Cao¹, Yanrui Gao¹, Linfeng Li^{1, 2#}, Ying Zou^{1#}, Howard I. Maibach³

1. Skin and Cosmetic Research Department, Shanghai Skin Disease Hospital, Tongji University School of medicine, Shanghai, China
2. Department of Dermatology, Allergy and Clinical Immunology Center, Beijing Friendship Hospital, Capital Medical University, Beijing, China
3. Department of Dermatology, School of Medicine, University of California San Francisco, California

Corresponding Author

Corresponding Authors

Ying Zou M.D. & Ph.D.

Skin and Cosmetic Research Department, Shanghai Skin Disease Hospital, Tongji University School of medicine, 1278 Bao De Road, Shanghai, 200443, China

Tel: +86-21-61833069; Fax: +86-21-61833062;

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/cod.13701

E-mail: zouyingsh@163.com;

Linfeng Li M.D. & Ph.D.

1. Skin and Cosmetic Research Department, Shanghai Skin Disease Hospital,
Tongji University School of medicine, Shanghai 200443, China
2. Department of Dermatology, Allergy and Clinical Immunology Center,
Beijing Friendship Hospital, Capital Medical University, Beijing 100050,
China

Tel: +86-10-63139108

E-mail: zoonli@sina.com

Conflict of Interest

There is no conflict of interest for any of the authors.

Running head

Updated Survey of Patch Testing in China

Abstract

Background. Patch testing, the standard method for diagnosing allergic contact dermatitis, has been utilized for ~30 years in China. A 2006 survey found that patch testing was widespread among Chinese dermatologists, but the practice and perceptions were unsatisfactory.

Objective. To evaluate the current situation of patch testing practice and perception, we re-surveyed Chinese dermatologists.

Methods. A cross-sectional survey of Chinese dermatologists was conducted by electronic questionnaires at the 15th National Congress of Dermatology in November 2019.

Results. There were 2199 valid questionnaires collected. Seventy-five per cent of dermatologists performed patch testing; the majority (59.2%) utilized the baseline (standard) allergen series made in China; more used TRUE Test or the Chemotechnique Diagnostics series, compared with 2006. Most (92.8%) performed only one single reading, more than 2006. About two-thirds offered patient education post patch testing, but only 27% were executed by trained dermatologists. Dermatologists from regional hospitals more likely performed patch testing and had better perception of patch testing. The majority (88.1%)

had received patch testing training, which however did not significantly improve dermatologists' perception.

Conclusions. There was insignificant improvement in practice and perception of dermatologists compared with 2006. Further education and studies should be conducted. Similar surveys in other countries would be of interest.

Key words: Chinese dermatologists; patch testing; survey; questionnaire

1. Introduction

Contact dermatitis is a common inflammatory skin disease in industrial and developing countries.¹ Patch testing, the standard method for diagnosing allergic contact dermatitis (ACD), is regarded as a significant advance in dermatology in the 20th century. Patch testing is being utilized in China for > 30 years, but has no national standard method or allergen series. To understand patch testing practices and the perception of dermatologists in China, we conducted an on-site survey in 2006: Chinese dermatologists widely used patch testing, but further improvement and education regarding the procedure appeared indicated.² Given the rapid medical and economic development in the past 13 years in China, we resurveyed the prevalence of patch testing and the current perception and methods, hoping to investigate the situation change compared with the 2006 survey.

2. Methods

An electronic questionnaire was distributed to dermatologists attending the Chinese Dermatologists Association Annual Congress in November, 2019. Participants completed the questionnaire composed of basic demographic

information and 13 multiple-choice questions on site. The questions consisted of two categories.

The first set focused on patch test practices and methods:

Q1. Do you perform patch testing?

Q2. Which chamber do you use?

Q3. Which 'standard' series do you use?

Q4. How long do you leave the patch on?

Q5. When do you perform readings?

Q6#. Do you conduct such patient education after patch testing?

Q7#. Who conducts patient education after patch testing?

The second category included questions related to training of dermatologists and their perceptions of patch testing:

Q8#. Have you received patch testing training?

Q9. For which skin diseases could patch testing be used for diagnosis?

Q10. When is the most suitable time to perform patch testing?

Q11. What is the most suitable anatomical site for patch testing?

Q12. What is the reaction of a patch test scoring ++?

Q13. Who would read the patch test reactions?

New questions added in Survey 2019. Others were same with that in Survey 2006.

Accepted Article

Data were recorded on a standardized computer entry form, and statistical analysis performed with SPSS version 21 (SPSS, Chicago, Illinois). Pearson χ^2 -tests were used to test for associations between demographic characteristics of the respondents and patch test practices or perceptions. The consistent questions inquired in the present survey (Survey 2019) and the previous one (Survey 2006) were compared and the results between both were tested using a χ^2 -test. $P < .05$ was considered statistically significant.

3. Results

3.1 Respondents

There were 2199 valid electronic questionnaires collected. Among respondents, 13.0% were chief dermatologists, 14.0% associate chief dermatologists, 14.3% attending dermatologists, 16.2% residents, 14.2% were trainees, and 13.9% clinical technicians. Most (70.0%) were from a regional hospital. The remaining were working in a district hospital (21.0%) or community hospital (9.0%).

3.2 Patch test practices

Seventy-five per cent (1655 of 2199) of respondents stated that they performed patch testing. Of those who did, 69.8% stated that they patch-tested at least once monthly (Table 1).

3.3 Patch test methodologies

The majority (58.7%) used chambers made in China. About 33.3% of testers used Finn Chambers or plastic chambers (I.Q. chambers). Most (59.2%) used allergens made in China as the baseline series , and 42.1% used the pre-prepared TRUE Test series or the Chemotechnique Diagnostics baseline series. Results showed that 40.2% of testers left the patches on for 1 day, and 34.2% for 2 days. Most (92.8%) of patch test reading scale was only once at 0.5hr, D1, D2 or D3, or D7 after removal (Table 1). About two-thirds of testers (65.3%) stated their group offered health education and explanations for patients after patch testing, while 25.6% did this occasionally and 9.1% not at all. The majority (62.3%) of staff responsible for such education were dermatologists, others were dermatologists in training (27.5%), nurses (24.1%), and trained medical researchers (16.8%).

3.4 Training and Perception of patch testing

The majority (88.1%) had received patch testing training from different resources, including specialized or general training for patch testing and learning from conferences and lectures (Table 2). Responses to Q9-Q13 about patch test perception are in Table 2.

3.5 Association with patch testing

Dermatologists from regional hospitals were significantly more likely to perform patch testing ($P < .001$) and have better perception of patch testing (Q10, $P = .004$; Q11, $P = .003$ and Q13, $P = .001$). Results of the patch test perception did not vary significantly by the grade of dermatologists ($P > .05$). More dermatologists who received patch test training performed patch testing. Perception of patch testing was not significantly associated with training for most questions. (Table 3)

3.6 Comparing Survey 2019 and 2006 results

About twice as many respondents completed the questionnaire in the 2019 survey than in 2006. Most results showed significant differences between the surveys: prevalence of patch testing (75.3% vs 86.0%) was lower in Survey 2019 than 2006 ($P < .001$). Use of True Test and Chemotechnique Diagnostics

mmaterial increased in survey 2019 ($P < .001$). More testers performed a single reading (92.7% vs 87.6%) in 2019 ($P < .001$) (Table 1). In terms of perception, Q9-13 showed a decrease in percentage of optimum choices (Table 2).

4. Discussion

This on-site survey, consistent with the previous one, avoided the response bias of mailed or emailed surveys. Furthermore , electronic questionnaires were more convenient and efficient than previous paper questionnaires and avoided invalid records due to writing errors.³

Considering the greater sample size in the present survey, it may be more representative than the former one. We are surprised that 75% of dermatologists practised patch testing at present, a significant decrease from 86% in the 2006 survey.² This prevalence rate is also lower than the 83% of US dermatologists,⁴ but higher than the 61% in Australia reported in 2012.⁵ Some change in the medical situation in China could account for this decrease. In 2012, the Chinese government launched a nationwide reform of public hospitals with the goal of controlling the rapid growth of healthcare expenditure.

Key components of the reform were the zero markup drug and material policy. The policy change led to a reduction in drugs and sanitary material shares and, to offset the reduction, an increasing provision of service or tests with higher price-cost margins.^{6,7} In terms of reimbursement systems in China, patch testing expenses are covered by public medical insurance, but these are much lower than other countries. As a result, dermatologists were less motivated to perform patch testing with little or no profit. Furthermore, burnout, a syndrome resulting from overload and stress during work, among doctors in China is another point could not be ignored.⁸ A survey reported that patient visits per physician in China increased by 135% and physician workload increased dramatically between 1998 and 2016.⁹ There is no limitation of how much time each physician should spend with patients, but treating more patients means a shorter time available for each of them. Dermatologists workload impeded their performing patch testing which is time-consuming and labor-intensive.

Outcome of patch testing depends on multiple factors including patch test system and test material.^{10,11} The results showed that diverse patch test series and chambers were used in different hospitals in China. Prevalence of TRUE Test and Chemotechnique Diagnostics series, both imported, increased significantly compared with that in Survey 2006.² After its launching, TRUE

Test continues to be a popular choice for US dermatologists due to its convenience.⁴ The usage rate (47%) in Australia is also higher than that in China.⁵ Chemotechnique Diagnostics series is a common commercial patch system used world wide.^{12,13} A majority of testers (76%) in Scotland reported using Chemotechnique Diagnostics series.¹⁴ It is encouraging that currently more hospitals employ these two systems. Correspondingly, more testers utilized imported plastic chambers (I.Q. chambers) than 13 years ago. These changes indicate an international trend of patch testing practice in China. It is also a starting point for participation in worldwide multi-centre research.

Nevertheless, the dominant series employed in China remain domestic systems. The Peking Medical University baseline series was the most commonly employed. Many countries or regions have developed baseline series to make patch testing more locally relevant. Several self-claimed basic standard series were also developed during the late 20 century in China, such as Peking Medical University baseline series and Nanjing Medical University standard. Moreover, there are many integrative patch testing series available besides the baseline one, such as Cosmetics Series, Drug Series, Dental series, Daily Life Series, Classic Composite Series, Orthopedic Series, etc. However, these “Chinese Baseline Series” are empirical generalizations.

There is no data-based research support and none of the above standard series have been approved by China Food and Drug Administration (CFDA, now “National Medical Products Administration”, NMPA). Hence, there is no national standard method or allergen series used to perform patch testing in China. To establish a Chinese baseline series, we performed a retrospective review of 30-years published data from contact dermatitis clinic in China, and proposed the first evidence-based Chinese baseline series.¹⁵ Further multi-centre prospective research should be conducted for better identification and applicability.

It is discouraging that 92.8% of testers performed only one patch test reading. This proportion was higher than the 87.6% in 2006.² An international survey on World Allergy Organization members showed that only 12% had one single reading,¹⁶ ie, a much lower share than that in our survey. In the United Kingdom and Republic of Ireland, the majority of participants performed two or three readings.¹⁷ Single readings lead to false-negative and false-positive reaction. The frequency of readings decreased possibly because of the unreasonable health human resource allocation,¹⁸ which means a shortage of health care staff in some hospitals and less time to treat patients. Furthermore, we investigated the instructions of some domestic commercial patch test

products and found the instructions for the reading time was shown as '30 minutes after patch removal'. The misleading instructions may be a cause of the deficient reading scale of Chinese dermatologists. Further education on patch testing reading is essential during professional training in China.

In consideration of the importance of patient education for patch testing, we investigated the situation in the updated survey. This demonstrated that most testers interpret the results to patients. This rate (91%) is lower than the 100% of Scottish dermatologists who gave advice to their patients after testing.¹⁴ The new edition of ESCD guideline emphasizes the important patient education on allergen avoidance.¹³ Successful patient education and management are as important as the identification of allergens through patch testing.^{1,19,20} Patient education is usually performed in verbal and written forms in China. Patients are provided a general list of allergens to avoid. Interpretations were provided to patients including how to identify allergens in various items, avoid similar allergens/cross-allergies and read products ingredient label. The Chinese Expert Consensus on Patch Test also emphasized that interpretation should be conducted specifically by dermatologists.²¹ Unfortunately, few testers in China realized this point. Our data demonstrated that only 27% of interpretation was in the charge of the trained dermatologists. Future

educational effort on the patient education is another key point for better practice in China.

Patients can attend dermatology clinic directly in China; referral is not required, while the practice of patch testing varies according to educational background and experience of dermatologists. Thus, we previously pointed out the importance and essence of training for patch testing.² In fact, China recently realized the necessity of education reform in 2009 and issued a policy on standardized training for residents. Specific patch testing training is provided during dermatology rotation, which was not previously regularly available. To understand the current situation and investigate the influences on patch testing of the new training system, we updated our survey with related questions. Our study demonstrates that 32.6% of respondents received professional training, which is much lower than the 83% of Australia dermatologists.⁵ The low proportion is plausible since the late policy has been implemented for only 10 years. It is encouraging that the dermatologists received training performed patch testing more than who did not. Yet the training did not improve dermatologists' perceptions. The results showed that Chinese dermatologists' perception of the patch testing remains unsatisfactory, and worse than 13 years ago. The fact that the wrong instructions on marketed patch systems

and less interest of dermatologists in contact dermatitis should be taken into account.⁴ Moreover, this strongly suggests that our current training (including standardized training) is insufficient to improve perception. Better training models and assessment systems should be implemented. There was no association between the grade of dermatologists and the perceptions of patch testing - consistent with that of Survey 2006.² This suggests that dermatologists in each grade of their careers still have insufficient understanding of patch testing.

To improve the practice of patch testing, several measures may be considered. More standardized training needs to be implemented to improve dermatologists' perception of patch testing. The National Health Commission could establish more national regulations to promote the standardization of patch testing. An effective health-care reform and legislation will be helpful to ease the burden on medical personnel.

There are several limitations to this study. First, the survey was conducted at a national annual congress, therefore, individuals who did not attend the meeting are not represented. In addition, the study was limited to Chinese dermatologists, although this was purposeful so that we could understand the situation patch testing in China. Finally, additional questions could be helpful to

better understand of Chinese patch testing practices, since no improvement observed in the updated survey, such as questions about dermatologists' interest in patch testing and time they are willing to spend. Further research needs to be conducted.

In conclusion, the diversity of patch test materials used by dermatologists in China increased and there was no significant improvement in practice and cognition of dermatologists compared with 2006. Although China strengthened patch test education, a long way towards standardization of allergens, patch test materials, and the methodologies is yet ahead. Further education and studies should be conducted to improve the situation. Similar survey worldwide should clarify if these are only China issues — or of a more generalized nature. We suspect the latter.

References

1. Burkemper NM. Contact Dermatitis, Patch Testing, and Allergen Avoidance. *Missouri medicine*. 2015;112(4):296-300.
2. Zou Y, Wang XM. Patch test practices and perceptions of Chinese dermatologists: results of a cross-sectional survey. *Contact dermatitis*. 2012;66(4):205-9.
3. Tu CY, Tseng MM, Chang CH, Lin CC. Comparative validity of the Internet and paper-and-pencil versions of the Night Eating Questionnaire. *Comprehensive psychiatry*. 2017;75:53-61.
4. Warshaw EM, Moore JB, Nelson D. Patch-testing practices of American Contact Dermatitis Society members: a cross-sectional survey. *American journal of contact dermatitis : official journal of the American Contact Dermatitis Society*. 2003;14(1):5-11.
5. Tizi S, Nixon RL. Patch testing in Australia: Is it adequate? *Australas J Dermatol*. 2016;57(3):192-8.
6. Fu H, Li L, Yip W. Intended and unintended impacts of price changes for drugs and medical services: Evidence from China. *Soc Sci Med*. 2018;211:114-22.
7. Deng J, Tian H, Guo Y, et al. A retrospective and prospective assessment of the zero-markup drug reform in China from the perspective of policy diffusion. *The International journal of health planning and management*. 2018;33(4):e918-e29.
8. Zheng Q, Yang K, Wang X, et al. Burnout among doctors in China through 2018: A protocol of systematic review and meta-analysis. *Medicine (Baltimore)*. 2019;98(37):e17117.
9. Fu Y, Schwebel DC, Hu G. Physicians' Workloads in China: 1998(-)2016. *Int J Environ Res Public Health*. 2018;15(8).
10. Isaksson M, Gruvberger B, Frick-Engfeldt M, Bruze M. Which test chambers should be used for acetone, ethanol, and water solutions when patch testing? *Contact dermatitis*. 2007;57(2):134-6.
11. Lachapelle J-M, Maibach HI. *Patch Testing and Prick Testing*, 4th edition. Springer; 2020.
12. Wilkinson M, Gonçalo M, Aerts O, et al. The European baseline series and recommended additions: 2019. *Contact dermatitis*. 2019;80(1):1-4.
13. Johansen JD, Aalto-Korte K, Agner T, et al. European Society of Contact Dermatitis guideline for diagnostic patch testing - recommendations on best practice. *Contact dermatitis*. 2015;73(4):195-221.
14. Bong JL, Fleming CJ, Forsyth A. Survey of patch testing in Scotland. *Contact dermatitis*. 2000;43(1):31-4.
15. Johansen JD. *Contact Dermatitis*, 6th edition. Springer; 2019.
16. Tanno LK, Darlenski R, Sánchez-García S, et al. International survey on skin patch test procedures, attitudes and interpretation. *The World Allergy Organization journal*. 2016;9:8.
17. Bhojru B, Keegan S, Mughal A. National survey of patch testing in the United Kingdom and Republic of Ireland: what proportion of the population is and should be tested? *Contact dermatitis*. 2018;78(6):393-398.
18. Lei P, Feng Z, Ding JN, Duan R, Yu H, Liu QC. Evaluation of the status quo of medical resource allocation and service utilization in China. *Health Economics Research*. 2019;36(05):50-5.
19. Smith MC. Patient education to enhance contact dermatitis evaluation and testing. *Dermatologic*

clinics. 2009;27(3):323-7, vii.

20 Mowad CM, Anderson B, Scheinman P, Pootongkam S, Nedorost S, Brod B. Allergic contact dermatitis: Patient management and education. *Journal of the American Academy of Dermatology*. 2016;74(6):1043-54.

21 Hao F, Li LF. Expert consensus on clinical application of patch testing. *Chinese Journal of Dermatology*. 2020;53(4):239-43.

Table 1. Patch test practices and methods

	Survey2006	Survey2019	χ^2	P-value
	No.(%)	No.(%)		
Patch test frequency	n=1089	n=2199		
Never do patch test	153(14.0)	544(24.7)	41.19	<.001
Less than once a month	156(16.7)	499(22.7)	31.93	<.001
1~3 times a month	322(34.4)	557(25.3)	6.68	0.01
At least once a week	458(48.9)	599(27.2)	73.31	<.001
Chamber used[†]	n=936	n=1655		
Chambers made in China	584(62.4)	971(58.7)	3.45	0.06
Finn Chambers	230(24.6)	376(22.7)	1.15	0.28
Self-made filter papers	123(13.1)	346(20.9)	24.32	<.001
Plastic chambers (I.Q.)	25(2.7)	176(10.6)	52.99	<.001
Others [‡]	34(3.6)	315(19.0)	121.67	<.001
“Standard” tray used[†]	n=936	n=1655		
Peking Medical University standard	407(43.5)	508(30.7)	59.72	<.001
Nanjing Medical University standard	349(37.3)	472(28.5)	11.74	0.001
TRUE Test	78(8.3)	450(27.2)	23.68	<.001
Chemotechnique	41(4.4)	247(14.9)	202.53	<.001
Self-made (new option in 2019)	/	188(11.4)	/	/
Others	82(8.8)	379(22.9)	81.72	<.001
Patch test reading schedule (after removal)	n=936	n=1655		
0.5 hr only	191(20.4)	458(27.7)	16.82	<.001
D1 only	281(30.0)	495(29.9)	0.04	0.95
D2 only	230(24.6)	309(18.7)	12.64	<.001
D3 only	116(12.4)	223(13.5)	0.62	0.43
D7 only	2(0.2)	49(3.0)	23.38	<.001
More than one time	116(12.4)	121(7.3)	18.58	<.001

Data were analysed with the Pearson χ^2 -test with one degrees of freedom (d.f.).

[†]Total percentage may be greater than 100%, because some respondents chose more than one answer.

[‡]Others: Chambers from other countries, such as van der Bend from The Netherlands and other, self-made materials (gauze, tapes, etc.)

Table 2. Training and perception of patch testing

	Survey 2006 n=1089(%)	Survey 2019 n=2199(%)	χ^2	P-value
Q8[‡]				
Specialized training	/	716(32.6)	/	/
General training during dermatology course	/	727(33.1)	/	/
Simply learned from conferences & lectures	/	492(22.4)	/	/
Never trained	/	264(12.0)	/	/
Q9[†]				
Allergic dermatosis [§]	792(72.7)	1637(74.7)	1.11	0.29
Chronic eczema of uncertain cause	469(51.3)	1155(52.5)	0.42	0.52
Irritant contact dermatitis	559(43.1)	1228(55.8)	47.61	<.001
Allergic contact dermatitis	668(61.3)	1220(55.5)	10.23	0.001
Q10				
Acute stage	116(10.7)	648(29.5)	111.73	<.001
Chronic stage	139(12.8)	460(20.9)	18.65	<.001
Immediately after lesions resolved	83(7.6)	303(13.8)	16.86	<.001
Two weeks after lesions resolved	628(57.7)	788(35.8)	231.09	<.001
Q11				
Upper back	685(62.9)	1162(52.8)	21.07	<.001
Flexor aspect of forearms	300(27.5)	594(27.0)	0.02	0.90
Flexor aspect of upper arms	93(8.5)	306(13.9)	22.02	<.001
Extensor aspect of upper arms	41(3.8)	137(6.2)	9.62	0.002
Q12				
Erythema, infiltration	64(5.9)	393(17.9)	87.56	<.001
Erythema, infiltration, possibly papules	565(51.9)	1187(54.0)	1.29	0.26
Erythema, infiltration, papules, vesicles	330(30.3)	411(18.7)	56.26	<.001
Erythema, infiltration, vesicle, bullous	42(3.9)	208(9.5)	32.54	<.001
Q13[†]				
Nurse	26(2.4)	316(14.4)	112.82	<.001
Dermatologist	390(35.8)	1331(60.7)	181.37	<.001
Trained medical researcher	53(4.9)	398(18.2)	108.48	<.001

Trained dermatologist	543(49.9)	720(32.9)	88.79	<.001
-----------------------	-----------	-----------	-------	-------

Data were analysed with the Pearson χ^2 -test

[†]Total percentage may be greater than 100%, because some dermatologists chose more than one answer.

[‡]New questions in Survey 2019

[§]skin conditions related with allergy, i.e. contact dermatitis, atopic eczema, seborrheic dermatitis, nummular eczema, hand eczema etc.

Table 3. Association of training received with patch test (PT) practice and perception

	The training received			
	Specialized training (%)	General training (%)	Simply learned (%)	No training (%)
<i>PT practice</i>				
Perform PT	562(78.5)	575(79.1)	362(73.6)	156(59.1)
Do not PT	154(21.5)	152(20.9)	130(26.4)	108(40.9)
n=2199	$\chi^2 P< .001$			
<i>Suitable time to perform</i>				
Right answer	481(67.2)	444(61.1)	322(65.4)	164(62.1)
Wrong answer	235(32.8)	283(38.9)	170(34.6)	100(37.9)
n=2199	$\chi^2 P=0.08$			
<i>Suitable site for PT</i>				
Right answer	457(63.8)	391(53.8)	212(43.1)	102(38.6)
Wrong answer	259(36.2)	336(46.2)	280(56.9)	162(61.4)
n=2199	$\chi^2 P< .001$			
<i>PT reaction reading</i>				
Right answer	116(16.2)	132(18.2)	120(24.4)	43(16.3)
Wrong answer	600(83.8)	595(81.8)	372(75.6)	221(83.7)
n=2199	$\chi^2 P=0.02$			
Data were analysed with the Pearson χ^2 -test				

Data were analysed with the Pearson χ^2 -test