

Short Communication

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Suggestions to Improve Medical Education in China-Learning from Diagnostic Errors of Kidney Diseases

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ABSTRACT

A correct diagnosis is key to deliver the safe and effective medical interventions. However, diagnostic errors that can jeopardize patients' safety are common in clinical settings. Herein, we analyzed diagnostic errors in kidney disease cases based on our clinical experience, explored the factors underlying diagnostic errors, and discussed ways to improve medical education in China. In kidney disease, diagnosis is complicated by the kidney's physiological characteristics and the lack of sensitive early diagnostic methods. Additionally, there are shortcomings in Chinese healthcare service patterns and the Chinese medical education. There are not enough qualified General Practitioners (GPs) in China, resulting in a low-efficiency referral system. Clinical training for postgraduates is hindered by the pressure to publish papers. Continuing medical education in China seems to be oriented improperly, with insufficient focus on the progress of clinical practice. We believe that targeted measures should be enacted to address the aforementioned problems in China. Specifically, we recommend that medical education should incorporate evidence-based diagnostic mind maps and lessons from diagnostic errors.

KEYWORDS: Medical education; Diagnostic error; Kidney disease; Diagnostic mind map.

OBJECTIVE

Correct diagnosis is a prerequisite to providing proper medical treatment. However, *to err is human*.¹ Diagnostic errors occur often in clinical settings, which may bring about detrimental consequences such as treatment delays and even mortality. Employing our clinical experience, we analyzed diagnostic errors in kidney disease cases in China to explore how medical education system could be improved.

MISDIAGNOSIS OF KIDNEY DISEASES

Kidney diseases have high incidence rates in China. Zhang et al estimated that the prevalence of chronic kidney disease (CKD) in adults was about 10.8% in China, with only 12.5% of those affected being aware of the condition.² We have collected 1,662 cases involving chronic kidney failure misdiagnosis in 61 Chinese medical articles, published from 2004 to 2013. The time to rectify the misdiagnosis in these cases varied from less than a month to several years.³ The prevalence of misdiagnosis is partly due to the kidney's physiological characteristics and a lack of early diagnostic methods. Owing to the kidney's strong compensatory ability, patients

with early-stage renal dysfunction or injured kidneys may not have symptoms. Changes in serum creatinine (sCr) levels may not be clinically detectable until nearly 50% of kidney function has been lost.⁴

Suggestion 1: Maintain a Master-Apprentice System for Medical Practice and Enhance General Medical Education in China

China has a unique traditional medical practice system that is totally distinct from systems in western countries. The majority of physicians in China are practice semi-independently in public hospitals with their daily clinical activities being conducted under the supervision of senior physicians. It is customary that Chinese physicians undergo ongoing medical education from their supervising senior physicians throughout their careers. We suggest that this master-apprentice system be expanded and carried forward.

On the other hand, there are shortcomings in Chinese healthcare service patterns and medical education that may contribute to the commission of diagnostic errors. Before 1984, the three-tiered rural medicare system in China was one of the best healthcare systems in the world.⁵ However, China has yet to establish an efficient dual referral system between community health centers and large hospitals. Patients in China usually seek the care of specialties at large hospitals directly as a first point of contact, without advice from a general practitioner (GP), even for common ailments. This circumstance produces an immense outpatient workload for large hospitals. A specialist may have only approx. 3-5 minutes to consult with each patient. Factors such as inappropriate specialist visits, specialists' limited knowledge of general medicine, time-limited communication, and limited knowledge of patients' history all contribute to diagnostic errors. Visiting GPs firstly is helpful for the choice of appropriate specialist if necessary. However, China now faces a severe shortage of registered GPs (only ~150,000) for its massive population.⁶ Of the 168 medical schools in China, only ten offer bachelor's degrees in general medicine. To improve healthcare safety, China should enhance general medical education to cultivate more GPs for community health centers, so that these centers can act as more effective facilitators in the delivery of healthcare services and a more efficient referral system can be developed.

Suggestion 2: Emphasize Clinical Training in Postgraduate Medical Education

In China, prescription rights are usually granted after one finishes a 5-year bachelor's degree in medicine and one additional year of clinical practice, and then passes a medical license examination. Nevertheless, upon passing the examination, physicians' clinical abilities are still limited. Additionally, master and doctor of medicine programs are available. However, due to pressure to publish basic research papers, postgraduates focus on research activities, which compromise clinical training. An experience of the present paper's co-author Kunmei Ji exemplifies this prob-

lem. He sought care in a large Shenzhen hospital in 2005 due to hematuria, dizziness, and vomiting. Based on the findings of hematuria and proteinuria together with negative signs of renal calculi in ultrasound examination, he was diagnosed imprudently with renal lithiasis and medicated accordingly. His condition deteriorated within 2 days, and he was then diagnosed with kidney failure at another hospital with his sCr level reaching 1100 $\mu\text{mol/L}$. The original physician had a medical doctorate with a good publication record, but did not know that it is essential to test for sCr levels in patients with hematuria, revealing a weakness in his medical education. Fortunately, the Chinese government became aware of the clinical shortcomings of Chinese medical undergraduates and graduates and has, consequently, instituted a policy requiring standardized medical residency training for 2-3 years, which represents important medical education advancement.

Suggestion 3: Refresh Clinical Knowledge through Continuing Medical Education

Continuing medical education (CME) seminars are an effective way to help physicians improve their clinical skills. Clinically related CME topics – such as new diagnostic methods, new treatment approaches, clinical experience, and clinical case analysis seminars – would be particularly beneficial. For example, there is an international consensus that estimated glomerular filtration rate (eGFR) is a much better indicator of renal function than sCr. However, many Chinese doctors still rely on sCr (normal: 44-133 $\mu\text{mol/L}$) and lack an appreciation for eGFR findings. To exemplify this point further, consider the case of a 65-year-old woman who was hospitalized for coronary artery disease and hypertension with comorbid diabetes. Her physicians concluded wrongly that her kidney function was normal based on her sCr level (127 $\mu\text{mol/L}$) and proceeded with coronary artery angiography (CAG). Tragically, three days after being subjected to CAG, the patient's sCr levels increased to 906 $\mu\text{mol/L}$ and she exhibited anuria. The patient died within 15 days, although receiving hemodialysis. According to the Modification of Diet in Renal Disease equation, this patient's eGFR before CAG was only 37.44 ml/(min. 1.73 m²), which indicates that she had phase-3 CKD, a contraindication for CAG. Such tragedies can be avoided if physicians are knowledgeable about eGFR. Hence, we believe that China's CME should focus on refreshing the clinical knowledge of Chinese physicians.

Suggestion 4: Establish Comprehensive Diagnostic Mind Maps During Medical Education

Standardization may reduce medical errors,⁷ but given the complexities of diseases, it would be unrealistic for physicians to rely on rigid rubrics to diagnose patients. Here we suggest that medical education may help to build upon integrated evidence-based diagnostic mind maps and learn lessons from diagnostic errors. The maps should be reliable, memorable, and concrete, connecting the characteristics of related diseases. For example, hematuria is a sign of both kidney and urinary tract disorders,

and is also associated with some systemic diseases and disorders of neighboring organs. In our clinical practice, a 35-year-old man presented with hematuria and proteinuria (8.0 g/ 24-hour urinary protein excretion) was initially suspected to have nephrotic syndrome. However, his serum albumin level was assayed within normal range. Considering other possibilities, we performed more laboratory tests. And then he was found to have low coagulation factor VIII levels. So he was supplied with coagulation factor VIII. Consequently, his hematuria and proteinuria disappeared. He was finally diagnosed as hemophilia A. The case revealed that a comprehensive diagnostic mind map could help physicians to seek more evidence towards the correct diagnosis.^{8,9} Medical education and CME should include analysis of misdiagnoses so that medical students and physicians have the opportunity to learn from others' diagnostic errors and enhance their diagnostic proficiency.

CONCLUSIONS

In the past six decades, improvement of Chinese mass population's healthcare system is partially due to medical education. Here, we analyzed cases of misdiagnosis of kidney diseases in China and discussed the potential shortcomings in Chinese medical education system. Therefore, we suggest that China enhance general medical education, emphasize clinical training in post-graduate education, standardize medical residency training, and renew the clinical knowledge of all licensed physicians through CME. In addition, it would be worthwhile to help medical students establish evidence-based diagnostic mind maps and learn from prior diagnostic error experiences.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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