

Awareness of interventional radiology before professional training and outcome measurement of an interventional radiology curriculum: a survey of third-year undergraduates in a Chinese medical college

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PURPOSE

We aimed to assess the awareness of interventional radiology (IR) among medical students, and to evaluate an IR curriculum in China.

METHODS

Between the academic years of 2008 and 2016, 517 third-year medical undergraduates, who successfully applied for an IR curriculum, received a survey related to IR before taking the course. Final exams were conducted after the IR course.

RESULTS

A total of 355 of the 517 medical students (68.67%) answered the survey; 81.97% of the respondents had heard of IR, 40.28% believed they understood what IR is, but no one was familiar with IR. The four most common pathways for medical students to acquire IR knowledge were via new media (e.g., internet, apps) (42.82%), a teacher/textbook (36.90%), a friend (32.68%), and traditional media (26.48%). The most familiar interventional procedures to respondents were percutaneous transluminal coronary angioplasty (PTCA, 78.59%) and transcatheter arterial chemoembolization (TACE, 44.51%). The results of the survey also indicated that 68.45% of the respondents wanted to learn about IR, but that only 47 male students (13.24%) considered a career in IR. The pass rate of the IR course final exam was 87.04%, i.e., 87.04% of the students successfully completed the course and final exam.

CONCLUSION

The IR knowledge of medical students in China is worse than that of European medical students. We suggest that providing medical students with general information about IR in the media, as well as via teaching and textbooks in medical school, requires prompt and significant attention. An IR curriculum is beneficial for increasing the IR knowledge of undergraduates.

Interventional radiology (IR), the percutaneous diagnosis and therapy guided with imaging equipment, is currently rapidly expanding in many clinical specialties (1–3). However, the trend forward has not been well-recognized in China, perhaps due in part to inadequate diffusion among medical students, who are the future referring physicians or potential interventional radiologists (4, 5). Several surveys conducted in the last decade revealed poor knowledge of, and limited exposure to, IR in the medical undergraduate curriculum (4–9). This has reduced the enthusiasm for pursuing this specialty, and has directly impacted the specialty's potential of being considered as a future career path (4, 6). Therefore, it is important to construct and develop various forms of undergraduate curricula, including formal and informal, to address the shortcomings of IR and attract brighter talents to the IR field (8–10).

According to the existing literature, several teams have made significant efforts to report on the status of medical students' knowledge of IR in Europe, Saudi Arabia, the United States of America, and Canada (4–10). However, more attention needs to be devoted to medical undergraduate students in China.

The goals of this study were to assess the awareness of IR among medical students and evaluate an IR curriculum in China.

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Methods

Study subjects

Between the 2008 and 2016 academic years, 517 third-year medical undergraduates successfully applied for an elective course in IR that is open to all third-year medical students at a medical college in China. Of the 517 students, 46.23% were women ($n=239$) and 53.77% were men ($n=278$). A total of 464 (89.75%) were majoring in clinical medicine, and 53 (10.25%) were majoring in medical imaging. All students received an elective survey related to IR before taking the IR curriculum. No surveys were excluded from this project unless the results of the questionnaire were blank or incomplete, the handwriting could not be accurately identified, or a student refused to participate. Final exams in the form of a paper were conducted at the end of the IR course to assess the effectiveness of the course.

Ethical approval

The protocol was approved by the clinical trial ethics committee/institutional review board (IRB) (No. 2018-026). Informed consent was not required because the survey was anonymous and voluntary.

Medical student survey

Awareness of IR was assessed using a self-administered questionnaire created for the third-year medical students to complete before taking the IR course. This survey was anonymous and voluntary, and all subjects were uniformly guided to fill in the questionnaire. The advice given to the subjects included the following: (a) do not sign your name, (b) this questionnaire is elective and can be refused, (c) how to fill in the questionnaire, and (d) the survey is not scored or associated with the following curriculum. The questionnaire was divided into two categories: baseline characteristics and multiple-choice questions (Appendix). Questions

were used to test knowledge of IR and focused on the medical students' attitudes toward IR. Both single and multiple answers for the same question were accepted.

IR curriculum & outcome measurement

The IR curriculum is a 12-week course and is the first IR course taught to medical undergraduates at medical college. This course was taught by an experienced interventional radiologist. After the final lecture, all the students received a test to assess their knowledge of interventional radiology. The test paper consisted of 5 terms to explain, 10 text completions, and 4 short-answer questions, which together add up to a total score of 100 (" ≥ 60 " to pass the exam). This score was incorporated into the final performance assessment of the students.

Data collection

Researchers were trained in all details related to the survey and final exam prior to the study. Baseline characteristics of the respondents, including gender and department, were obtained from the survey. The questionnaires and test paper scores were assigned by two independent researchers according to uniform criteria. The scoring procedures were independent and separate from the questionnaire procedures. Disagreements between researchers in decisions about test paper scores were resolved by consensus. All data were recorded and entered into SPSS software for analysis.

Statistical analysis

The categorical data are expressed as percentages. Statistical analysis of the difference between two categorical variables was performed using the Pearson chi-square test. A two-sided P value of 0.05 or less was considered a statistically significant difference. Statistical Package for the Social Sciences (SPSS) (SPSS 15.0 for Windows, SPSS Inc.) was used to perform the statistical analysis of all data sets.

Results

A total of 355 of 517 medical students (68.67%) enrolled in the IR program completed all questions in the questionnaire. Of the students involved in the survey, 176 were women (49.58%) and 179 were men (50.42%). The number of students majoring in clinical medicine and medical imaging was 307 (86.48%) and 48 (13.52%), respectively.

The majority of medical students (81.97%) had heard of interventional procedure before they applied for the IR course. Most of them (40.28%) believed that they understood what interventional procedure is. However, no one believed that he/she was familiar with interventional procedure. The responses to question 2 ("If yes to question 1, from where?"), regarding where the students had acquired their current IR knowledge, were: teacher/textbook (36.90%), traditional media (26.48%), new media (e.g., internet, apps) (42.82%), professional magazine (5.35%), friend (32.68%), physician/health care provider (20.56%), and unsure (7.89%). The survey indicated that most of the students knew at least one different name for IR. Of these, the most familiar terms were interventional therapy (76.90%) and interventional radiology (74.65%). For question 4, from a list of interventional procedures, percutaneous transluminal coronary angioplasty (PTCA) was obviously the most familiar (78.59%) to respondents. Outcomes of Questions 1–4 are reported in Table 1.

Regarding the students' attitudes toward the IR course, 68.45% reported that they would like to know more about IR, and 52.11% applied for the course at the recommendation of others. The outcomes of Question 5 are listed in Table 2. The last question asked the respondents to explain whether they were willing to consider interventional radiology as a career. Only 47 male students (13.24%) considered a career in IR, and 52 students (14.65%) were unsure.

A total of 517 third-year medical undergraduates applied for the IR curriculum. Of these, 67 failed to complete the course and final exam. The pass rate for the exam was 87.04%, i.e., 87.04% of the students successfully completed the course and final exam. The pass rate was also significantly lower for male students than for female students (81.65% vs. 93.31%; $P=0.000$). Outcomes of the final exam of the IR curriculum are summarized in Table 3.

Discussion

IR is not officially recognized by the government as a specialist subject in China, which is similar to its status in America and most European countries. The social perception and recognition of IR has also not been promoted effectively (11, 12). Therefore, IR is often overshadowed by other clinical subjects. A telephone survey

Main points

- The IR knowledge of medical students in China is worse than that of European medical students.
- Providing medical students with general information about IR in the media, as well as via teaching and textbooks in medical school, requires prompt and significant attention.
- An IR curriculum is beneficial for increasing the IR knowledge of undergraduates.

Table 1. Third-year medical students' knowledge about IR: outcomes of Questions 1–4 (n=355)	
Question/ Answer	n (%)
Question 1: Have you heard of interventional procedure?	
No	64 (18.03)
Yes	
- heard	95 (26.76)
- know	53 (14.93)
- understand	143 (40.28)
- familiar	0 (0)
Question 2: From where?	
Teacher/ textbook	131 (36.90)
Traditional media	94 (26.48)
New media	152 (42.82)
Professional magazine	19 (5.35)
Friend	116 (32.68)
Physician/ health care provider	73 (20.56)
Unsure	28 (7.89)
Question 3: Name of IR	
Interventional radiology	265 (74.65)
Interventional medicine	59 (16.62)
Interventional therapy	273 (76.90)
Others	31 (8.73)
Question 4: Types of interventional procedure	
Percutaneous transluminal coronary angioplasty	279 (78.59)
Transcatheter arterial chemoembolization	158 (44.51)
Percutaneous transhepatic biliary drainage	67 (18.87)
Percutaneous cerebral aneurysm coil embolization	94 (26.48)
Others	105 (29.58)

Table 2. Third-year medical students' attitudes toward IR: outcomes of Question 5 (n=355)	
Question/ Answer	n
Question 5: Why did you apply for this course?	
Like to know about IR	243 (68.45)
Need credit	14 (3.94)
Others suggested it	185 (52.11)
Random selection	9 (2.54)
Unsure	6 (1.69)

scheduled to receive interventional procedures, and reported that only 6% had heard of the field of IR before their referral. De Gregorio et al. (5) conducted a survey of 142 preclinical students in a Spanish university. The results revealed that 50.7% of the students believed their knowledge of IR to be poor, and only 41% believed they had adequate knowledge of IR. It is evident that the level of IR knowledge of medical students is significantly higher than that of common adults and patients. In this study, we surveyed 355 third-year, preclinical undergraduate students in Chinese medical college, and found that 18.03% had heard of IR, 26.76% had only heard of IR, and 40.28% understood what IR is. However, to our surprise, no respondent thought he/she was familiar with IR before he/she was exposed to the IR course. The data of this study is troubling, and indicates that the lack of IR knowledge among Chinese medical students is worse than among European medical students.

Interventional radiologists and medical IR societies are making a great effort to expand what is known about IR. Baerlocher et al. (13) made 6 results-based recommendations to increase public awareness about IR. Nissim et al. (14) performed an online survey to assess the exposure to, understanding of, and interest in IR among American medical students and found that these students had limited exposure to, and understanding of, IR. The researchers believed that greater exposure could improve both understanding of IR and recruitment. Branstetter et al. (15) demonstrated that early IR exposure in the first year of medical school improves the students' impression of the field and increases their interest. Kattapuram et al. (16) verified that an IR symposium was successful in terms of medical student exposure to, understanding of, and interest in IR. The North America Society of Interventional Radiology (SIR) and the Cardiovascular and Interventional Society of Europe (CIRSE) invited medical students to participate in their annual meetings, and set up a special scientific program for them (10, 14). In China, as in most other countries, medical students are provided with resources about the field of IR via different pathways. Our survey results revealed that new media, a teacher or textbook in medical college, a friend, and traditional media (e.g., newspaper, TV) were the top four pathways by which medical students acquired IR knowledge. Therefore,

and live interviews conducted in 2001 by the Dotter Interventional Institute and the SCVIR retained Riley Research Associates

revealed that only 2% of all adult respondents knew about IR (11). Baerlocher et al. (13) surveyed 100 patients who were

Table 3. Outcomes of the final exam of the IR curriculum (n=517)

Characteristics	n				Significance	
	Pass	Fail	Total	Pass rate (%)	χ^2	P
Gender						
Male	227	51	278	81.65	15.465	<0.001
Female	223	16	239	93.31		
Major						
Clinical medicine	400	64	464	86.21	2.789	0.095
Medical imaging	50	3	53	94.34		
Total	450	67	517	87.04		

providing medical students with general information about IR, including reading and audio-visual material in magazines and media, requires significant and prompt attention, as does teaching about IR and publishing papers on the subject in medical journals and textbooks.

IR, as a specialty with poor social and official recognition, is often referred to by several formal or informal titles by Chinese media and individuals. Fortunately, our data indicated that the internationally recognized designations, IR and interventional therapy, were the names most familiar to medical students in China (the recognition rates were 74.65% and 76.90%, respectively). These recognition rates are conducive to improving students' impressions of IR as a specialty.

In the past two decades, the volume of percutaneous arterial intervention procedures grew at a faster rate among cardiologists than it did among other physicians and radiologists (12). As a result, interventional radiologists have lost "turf wars" to cardiologists. Interventional cardiology, especially angioplasty, has become the predominant source of IR knowledge for people (4). In this study, PTCA was proven to be the most familiar interventional procedure to the survey respondents, as well. The survey indicated that there exists a significant difference between familiarity with PTCA and the second-most familiar IR technique, transcatheter arterial chemoembolization (TACE). The rates of familiarity with these techniques were 78.59% and 44.51%, respectively.

According to the medical literature, students' interest in IR is not the same in all countries (5, 8, 9, 14, 17). Nissim et al. (14)

reported that only 12.7% of students were interested in IR. De Gregorio et al. (5) indicated that almost all of the medical students reported that they wanted to learn about IR. Our data suggested that most respondents (68.45%) were interested in IR, but only a few males (13.24%) were willing to pursue a career in IR, which is similar to the results of another survey conducted by Leong et al. (4). The reasons for this similarity were not ascertained, but Leong et al. (4) inferred from another study (18) that a perceived lack of patient contact in IR was a significant reason. In terms of teaching practice, we believe that radiation exposure during IR procedures could be another important reason why medical students turn down IR as a career in China.

The teaching of IR in medical school will help to expand related knowledge and interest young talents, the potential interventional radiologists (19), to this field. Leong et al. (4) collected 234 valid questionnaires of final-year medical students in a European country and revealed that 3% felt that they had no knowledge of IR. Only 3.4% and 30% of the survey respondents, respectively, believed they had good or adequate knowledge of IR. This indicates that exposure to IR and/or IR rotation in traditional medical education programs is limited. Shaikh et al. (10) conducted a 10-hour teaching curriculum in IR, and found that it increased the knowledge and understanding of IR in undergraduate students. Therefore, an IR curriculum for medical undergraduates is urgently requested in all medical schools (20). An elective IR curriculum in medical college for third-year undergraduates has been offered since 2003. As was determined by our study, the pass rate of the final exam in

recent academic years was 87.04%, which indicates that the level of IR knowledge has increased significantly.

There were several limitations to this study. The first limitation was that the study population was a convenience sample of medical students who had already applied for an IR course. Therefore, selection bias may be inherent. Another limitation was the potential bias associated with the use of a self-administered questionnaire. Objective evaluation indicators were absent.

In conclusion, the IR knowledge of medical students in China is worse than that of European medical students. PTCA has been proven as the most familiar interventional procedure to medical students. We suggest that providing medical students with general information about IR in the media, as well as via teaching and textbooks in medical school, requires significant and prompt attention. As has been determined by this survey, most medical students are interested in IR, but only a few males are willing to pursue a career in IR. This study demonstrates that an IR curriculum is beneficial to increasing undergraduate knowledge of IR.

Conflict of interest disclosure

The authors declared no conflicts of interest.

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Appendix

Survey on awareness of interventional radiology

Gender Department

Questions:

1. Have you heard of interventional procedure before you applied for this course?
 - No, I haven't heard of it.
 - Yes, I've heard about it.
 - Yes, I know it.
 - Yes, I understand what interventional procedure is.
 - Yes, I'm familiar with interventional procedure.

2. If you answered yes to question 1, from where?
 - Teacher or textbook in medical college
 - Traditional media (newspaper, television)
 - New media (internet, apps)
 - Professional magazine
 - Friend
 - A physician or other healthcare provider
 - Unsure

3. If you answered yes to question 1, do you know any of the following names?
 - Interventional radiology
 - Interventional medicine
 - Interventional therapy
 - Others (Please fill in the name of the procedure you know)

4. If you answered yes to question 1, what procedures do you know?
 - Percutaneous transluminal coronary angioplasty
 - Transcatheter arterial chemoembolization
 - Percutaneous transhepatic biliary drainage
 - Percutaneous cerebral aneurysm coil embolization
 - Others (Please fill in the name of the procedure you know)

5. Why did you apply for this course?
 - I'd like to know about interventional radiology
 - I need credit
 - Others suggested it
 - Random selection
 - Unsure

6. Would you consider a career in interventional radiology?
 - Yes
 - No
 - Unsure