The Current Status of Orthopaedic Education in Iran: A Comparative Study of Knowledge and Skills of Graduates from Different Orthopaedic Training Centers Countrywide

Abstract

Background: To improve the education of orthopaedic residents and enhance patient care in the Iran's healthcare system, it is necessary to gather information about the current status of scientific, practical, and research-based education for residents.

Methods: The research project initially focused on examining the executive curriculum in 14 centers affiliated with 6 different medical universities. Subsequently, an investigation was conducted into human resources, infrastructure, operating room facilities, educational and research outcomes, as well as the regular implementation of practical examinations to evaluate the performance of residents during their residency years. All the aforementioned aspects were covered using a comprehensive questionnaire, which was distributed via the "Formafzar.com" website as a link to the heads of departments in these centers by the Iranian Orthopaedic Association. The relationship between facilities and equipment and passing the future specialized orthopaedic board examination was also evaluated.

Results: Among the examined centers, only 20% adhered to the criteria of Iran educational curriculum in all aspects of human resources, education, and research.

Conclusion: a regular evaluation of teaching methods used by international centers and the national curriculum is necessary for orthopaedic training centers in Iran. Additionally, regulatory systems should monitor the training process of orthopaedic residents to standardize services, equipment, and educational programs in the country.

Keywords: Residency, Education, Curriculum, Academic training, Orthopaedics

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Introduction

Since the education of orthopaedics is still evolving to train specialists with better scientific and practical knowledge worldwide, continuous evaluation and assessment of human resources, educational infrastructures of orthopaedic educational institutions, educational protocols, and research achievements of each medical educational center are necessary for updating and improving them, which is the first step towards enhancing the current educational status. In the four-year residency program, orthopaedic residents need to acquire sufficient practical and research skills in addition to theoretical knowledge. Currently, sufficient information about the scientific, practical, and research education of orthopaedic residents at the national level is not available, and some orthopaedic educational centers lack sufficient diversity in orthopaedic surgical procedures and adequate treatment and educational infrastructures, which may result in insufficient skills among graduates in this field. Therefore, to improve the educational level of orthopaedic residents and enhance patient care in Iran's healthcare system, it is necessary, as a first step, to gather information about the current status of scientific, practical, and research education of residents and compare the current situation with the national standard curriculum as well as the curricula of reputable international institutions.

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Currently, the evaluation of orthopaedic assistants for annual promotion and certifications and speciality diploma is only based on theoretical tests, and the practical evaluation system for residents is not implemented uniformly according to a predefined plan in all educational units of the country. Hence, awareness of the implementation of practical evaluation for residents will facilitate the development of a unified practical evaluation program throughout the residency period. Finally, considering the continuous scientific and practical changes in orthopaedics at the international level and the increasing use of modern orthopaedic techniques and tools, familiarity with research knowledge in this field is an integral part of the orthopaedic residency program. This can be achieved through initial and continuous monitoring of the research activities of residents and professors working in orthopaedic medical educational centers nationwide.

In reviewing articles related to better education and the development of educational protocols in the past years, the results of specialty board exams have always been considered a suitable criterion for evaluating the performance of educational methods at the end of the residency period [1-3]. Developing a suitable rotational program for educational rotations is also another appropriate way to improve the educational status among orthopaedic residents [4, 5]. Furthermore, according to previous studies in European countries, the need for continuous review of these rotations has always been raised, and the evaluation of the educational situation in orthopaedic surgery in developing countries should include academic training, surgical performance, and research [6, 7]. The use of in-training examinations during the training years, such as repeating these examinations on a monthly or six-monthly basis, has been one of the effective factors in improving educational performance and the results of specialty board exams at the end of the course [7, 8]. Previous studies have shown that one of the Appropriate methods for scientific and practical training among orthopaedic residents is the use of surgical practice laboratories on cadavers [9]. However, due to the lack of access to surgical practice laboratories on cadavers in the country, this issue will not be addressed, and in this regard, the facilities of clinical skills centers in 6 orthopaedic medical educational centers will be investigated.

Methods

To assess the current status of education, knowledge, and skills of graduates in the field of orthopaedics at different universities in Iran, three areas of scientific education, practical education, and research were evaluated and compared in 14 affiliated hospital educational centers of 6 medical universities in Iran, including Tehran, Shahid Beheshti, Kermanshah, Mashhad, and Hamedan. This study was approved by the National Strategic Research Center for Medical Education (Research Ethics Committee) with the code IR.NASRME.REC.1400.082. Scientific education was evaluated based on the implementation of the curriculum in the four-year residency period by universities, and then the pass rate and top rankings of residents in the written and oral specialized knowledge exam were examined, and the relationship between these successes and the implementation of the curriculum was investigated. The practical education of orthopaedic residents was assessed based on the frequency of implementation of the Direct Observation Procedural Skill Test (DOPS) protocol and MiniCEX (Clinical Evaluation Exercise) in the year under study. In all the above cases, a standardized orthopaedic education curriculum was used in designing the questionnaire. All the above cases were designed in a comprehensive questionnaire format, and this questionnaire was sent to the heads of departments of these centers through the Orthopaedic Scientific Society website as a link, and the responses were examined. The results of this questionnaire were entered into SPSS software version 26 and analyzed descriptively, reporting the data in terms of frequency distribution or mean.

Results

The average number of faculty members with fellowships in the field of orthopaedics in 14 university hospitals across the country showed a significant difference and a lack of coordination among centers. Among these centers, one center had no skilled individual in sub-specialties, while another center had 18 specialized experts with fellowships in all sub-branches of orthopaedics.

Additionally, there is a noticeable difference in the number of human resources in different centers across the country.

The top center had 24 orthopaedic faculty members, while the lowest had only 2 faculty members (Table 1).

In the evaluation of infrastructure in the 14 university orthopaedic centers at the national level, the number of beds in the orthopaedic department ranged from 25 to 180, and the number of ICU beds dedicated to the orthopaedic department varied from 0 to 30 beds. The number of active C-arms for orthopaedic surgeries ranged from 2 to 12 among these 14 centers. Furthermore, the annual number of surgeries and daily operation rooms were examined (Table 2).

In analyzing the number of orthopaedic residents, it was found that there were very few female residents in orthopaedics. There was a maximum of one female resident among these 14 centers. It was also found that residents only dropped out in their first year of training and there were no dropouts in subsequent years. This study showed that in the aforementioned training centers, rotations in paediatrics and spinal cord were less common compared to other areas, and some centers did not provide any advanced training in these areas. Furthermore, upon examining the training details, it was observed that some centers did not hold any morning report sessions, journal clubs, or educational lectures (Table 3).

Table 1: The results of the human resources survey of 14 orthopaedic academic centers in the country

Human resources (14 centers)	**Number of members** (min-max)	**Number of members** (Average)
Number of orthopaedic surgeons active in the hospital (both educational and therapeutic)	6-19 people	9.86±4.11
The number of faculty members of the Orthopaedic Department	2-24 people	9.00±5.63
The number of orthopaedic surgeons with fellowship degrees among the faculty members of the department	0-18	6.79±5.29

Table 2. The results of the study on the infrastructures of 14 orthopaedic university centers in the country

Infrastructures and facilities	**Results** (min-max)	**Average ± Standard deviation**
The number of beds in the orthopaedic department	180-25	77.08±43.69
Average monthly bed occupancy rate	100-55	15.66±82.08
The number of ICU beds for the orthopaedic department	30-0	8.91±5.90
The number of weekly general orthopaedic training clinics	10-2	5.29±2.36
The number of weekly subspecialty orthopaedic educational clinics	13-0	5.21±3.30
The number of patients visited weekly in educational clinics	1000-10	299.63±284.92
The number of daily operating rooms in the orthopaedic department	20-2	6.36±4.81
Annual number of orthopaedic trauma surgeries	12000-500	3767.77±3228.25
Annual number of non-trauma orthopaedic surgeries	3000-200	802.02±1074.92
Number of active C-arms for orthopaedic surgery	12-1	2.93±2.92

Table 3: Survey of residents under training in 14 university centers in the country		
Examining the number of residents, their performance, and evaluation tests	**Number of members** (min-max)	**Average ± Standard deviation**
The total number of orthopaedic department residents	44-12	21.79±10.05
The number of female residents of the orthopaedic department	1-0	0.51±0.50
The average number of residents in each stage	12-3	6.14±2.85
The number of first-year residents withdrawing in the last 5 years	10-0	5.07±3.14
The number of residents who quit higher education in the last 5 years	0	0
Number of DOPS tests conducted last year	4-0	1.33±1.23
Number of Mini-CEX tests administered in the past year	10-0	2.82±2.00
Number of OSCE exams conducted last year	4-1	1.75±0.96
The number of internal written exams last year	50-0	12.81±6.79
The number of written exams within the group last year	50-0	12.62±6.71
Number of training rounds per week	6-1	3.93±1.68
Number of educational grand rounds per month	4-1	2.43±1.45
Number of morning report sessions per week	6-2	4.50±1.28
Number of joint morning report sessions with other groups per year	12-0	4.86±4.86
Number of journal club meetings per month	6-0	3.43±1.65

In the evaluations of this study, it was shown that the acceptance rate for the board exam in the past 5 years ranged from 0-80%. However, there was one center that did not have any acceptances in the past 5 years in the board exams and started the orthopaedic assistant training only 4 years ago. The centers that had an acceptance rate of 80% and had a higher number of top rankings each year, met the criteria for curriculum infrastructure, human resources, the number of sub-specialty exams, and advanced training more than the other centers. The average acceptance rate of graduates from these centers in the board exam in the past 5 years was 53.71 ± 27.08. In the first university center, which had interns distributed in 3 affiliated teaching hospitals, the average acceptance rate was 76.77%, and in the second university center, which included 4 active teaching hospitals, one of which did not have any participants in the board exam due to being newly established in the field of orthopaedics during the study period, the average rate was 63.3%. The third university center with 3 active teaching hospitals had a 73.3% acceptance rate in these 5 years of evaluation. And the following 3 centers had acceptance rates of 55%, 35.89%, and 18% respectively (Table 4).

Table 4: Educational programs of 14 university centers nationwide			
Educational programs		**Results *** (min-max)	**Results *** numbers (percentage)
Existence of a specific educational curriculum in the department	Yes (number/percentage)	–	8 (%57.1)
	No (number/percentage)		6 (%42.9)
Orthopaedic training department rotations	the knee	0-11	11 (%78.57)
	Hip	0-11	11 (%78.57)
	the shoulder	0-10	10 (%71.42)
	ankle	0-8	8 (%57.14)
	tumor	0-8	8 (%57.14)
	spinal cord	0-7	7 (%50)
	children	0-4	4 (%28.57)
	trauma	0-13	13 (%92.85)

*The number of centers with the above rotations

Discussion

Based on the results of this study, there is a significant difference among educational centers in Iran in terms of human resources, infrastructure, operating room facilities, and educational and research outcomes. In terms of human resources, the number of active faculty members in each educational center varied between 2 and 24 individuals in a hospital, with one center having 18 personnel with fellowships and another center without fellowship personnel. In terms of infrastructure, the number of active orthopaedic beds varied between 25 and 180 beds. Additionally, the study revealed that certain centers did not perform arthroscopic surgeries, paediatric deformities, tumours, and spinal column procedures. This highlights the necessity of addressing these sub-specialized areas in line with the needs of patients and the community. In terms of educational outcomes, it was shown that some centers did not conduct any written or practical exams within the department during the year and only relied on annual competency exams. It is necessary to have a comprehensive evaluation of education, including regular practical and theoretical exams, in accordance with standardized teaching methods worldwide during the academic year [10-12].

Based on the results of this study and previous studies [13, 14], the difference in minimum human resources and equipment facilities in different centers should be highlighted. In addition to the development and implementation of regular training protocols in educational sectors of the country, regular monitoring and evaluation of facilities and protocol implementation methods should be mandatory.

According to the wide range of orthopaedic diseases and procedures, training in specialized departments is inevitable. The findings of this study in Iran have shown that fellowship surgeons are not available in some centers. Although the deficiencies in these subspecialty trainings should be compensated by well-equipped clinical skills centers, these centers also have not appropriate equipment for clinical skills training. The educational outcomes of this study have shown that centers that possess all these subspecialty rotations in one center have better training outcomes and higher success rates in board exams and certifications. Whether these findings apply to other centers and whether the pass rates in subspecialty board exams correlate with the facilities of a center should be investigated in future more detailed studies. This descriptive study merely reports the existing evidence among these centers.

Currently, to compensate for the rotations in centers without basic fasciitis, residents are obliged to complete them in other hospital centers where the efficiency of these rotations outside the primary center is generally lower for various reasons.

To enhance specialized and sub-specialized orthopaedic surgical education in the academic centers of our country, it is necessary to first focus on attracting human resources to promote comprehensive and sub-specialized training. One of the objectives of each center is likely to be the recruitment of individuals with fellowship qualifications or the requirement to complete fellowship courses for existing members of that center. Another necessary facility for training in the specialized field of orthopaedics is the availability of suitable arthroscopy and C-arm devices in that center. Among the examined centers, only 20% explicitly adhere to the country's curriculum criteria in all areas of human resources, educational, and research resources. One of the educational outcomes of the mentioned centers is the average pass rate of their graduates in the country's promotion and board exams. In examining these centers, the board exam results have varied among these centers in the past 5 years. Some centers have had a lower minimum average pass rate. Considering that this board exam just cannot assess the overall skills of graduates, this issue is of great importance. The main emphasis of this exam is on assessing the theoretical knowledge of graduates, and it does not adequately

evaluate the educational trainers. More clinical assessments the four years of residency training in these centers, through the implementation of DOPS and OSCE exams, are only conducted in a maximum of 28% of these centers. It is advisable for orthopaedic educational centers in the country to regularly examine innovative educational methods of international centers and the national curriculum, and also regular interval supervise the training process of specialized orthopaedic residents to standardize and harmonize services, equipment, and educational programs across Iran's departments.

Like all studies, this study also has weaknesses. Firstly, it was not possible to report the results and compare them to the international standard simultaneously due to the extensive nature of the questionnaire.

Secondly neither the initial admission grades of the residents and their original skills and knowledge, nor the time the educators had spent with the residents were considered. Thirdly, the 6 universities studied may not necessarily represent the whole country.

Future studies are suggested to compare these results with international centers in areas such as human resources, education, research, and infrastructure, using the available results and designed questionnaire.

Conclusion

Across the world, the goal of all educational institutions is to train experienced professionals in all fields of theoretical knowledge, practical skills, and mental abilities. To better emphasize the importance of implementing appropriate educational solutions during the residency period, it must be acknowledged that talented individuals exist in every society who will succeed despite any successful educational system. However, a successful educational system can train capable surgeons with appropriate training from among all individuals with all talents and abilities, who can possess minimum requirements in various aspects of orthopaedic surgery and continue their training throughout their years of practice.

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