

Case-based learning through small private online course for surgical internship teaching during COVID-19 pandemic in China

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Research article

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Abstract

Background

In China, the outbreak of novel coronavirus disease 2019 (COVID-19) was a severe public health emergency that postponed the spring-summer semester of schools and forced students to implement home quarantine to prevent community transmission. Surgical interns' regular learning was seriously affected during the pandemic, and was almost impossible to carry out.

Methods

This study aims to explore a novel online medical teaching method during the COVID-19 pandemic. A 12-week case-based learning through small private online course was conducted for 108 medical students who were supposed to practice surgery at the Second Xiangya Hospital of Central South University but were delayed because of the pandemic. At the end of the course, final test and questionnaire survey were completed. The scores of final tests were compared with those before pandemic of the same students when receiving traditional surgical internship teaching.

Results

The case-based learning through small private online course during the pandemic significantly increased the scores of students in the surgical basic knowledge(90.00 ± 4.76 vs. 85.81 ± 7.45 , $P = 0.003$) and clinical analysis ability(89.55 ± 3.41 vs. 84.57 ± 5.07 , $P = 0.000$), but decreased the scores of clinical operative skills(79.19 ± 5.52 vs. 85.28 ± 9.45 , $P = 0.002$). According to the survey, 91.6% of the students thought it was necessary to carry out the online internship teaching and 88.9% of students were satisfied with this teaching method.

Conclusions

It was concluded that case-based learning through small private online course effectively minimized the impact of COVID-19 for surgical intern teaching by providing high-quality education.

Background

The novel coronavirus disease 2019 (COVID-19) is now fast spreading to over 200 countries. In China, the outbreak of COVID-19 is also one of the most severe public health emergencies since it was founded in 1949. The first-level public health emergency response mechanism had been activated after the official announcement of the pandemic of COVID-19 in China, to prevent and control the spread. A series of effective measures were taken according to the public health emergency response to reduce the cross infection, including the extension of the Spring Festival holiday, the postponed spring-summer semester

of schools, the cancel of mass gathering activities and the control of transportation capacity. For an individual, home quarantine and personal protection equipment were implemented to prevent community transmission. And these measures had changed the trajectory of the pandemic in China^[1].

However, the postponed spring-summer semester severely affected surgical interns' regular learning and forced medical schools to adjust teaching plan. During the prevention and control of COVID-19, we tried to make good use of the online teaching courses to minimize the impact of the pandemic for surgical interns' teaching.

The online communication technology is regarded by the education community as an effective tool for education, especially in times of crisis and disaster. For instance, during the outbreak of SARS in 2003 in China, various online education application developed multiple channels for distance learning^[2]. Furthermore, the Ebola pandemic in 2014 seriously affected normal education process in Africa. Although the technology in Africa was limited, African governments still applied some online teaching to ensure part of the normal education^[3]. Nowadays, majority of the schools in China, especially the college, have been capable of conducting online theoretical courses. However, a dearth of practice has been done to explore the quality and feasibility of online internship teaching. Now that the severe pandemic had obstructed the participation of clinical work of surgical interns, we applied a novel online teaching mode as a substitute for traditional surgical internship teaching.

Small Private Online Course (SPOC), derived from Massive Open Online Courses (MOOC), was first proposed by Professor Armando Fox of the University of California, Berkeley^[4]. Compared with MOOC, SPOC is held in a smaller group with stricter criteria for admission^[5]. It not only inherits the advantages of MOOC such as highly self-learning, but also overcomes some of its shortcomings such as insufficient communication between student and teacher^[6]. Therefore, it is suitable for small group internship teaching during the pandemic. Case Based Learning (CBL) is a teaching mode in which the students discuss typical clinical cases under the instruction of teacher, which pay more attention on the clinical thinking of students rather than the theoretical knowledge^[7]. It is more conducive for students to apply the theoretical knowledge for clinical practice and enhance the ability of solving clinical problem compared with lecture-based study.

In this paper, a new CBL teaching mode based on SPOC (SPOC-based CBL) was proposed and applied to surgical internship teaching during the COVID-19 pandemic period and the effect of this teaching method has been assessed.

Methods

Participants

There were 108 medical interns who were supposed to practice the surgery in the second Xiangya hospital of Central South University. All students were divided into 12 groups randomly, 9 students for

each group, and 12 well-trained part-time doctors were responsible for teaching in this SPOC-based CBL teaching mode. We arranged 12 lessons to each student group.

Study setting

The study was conducted at the Second Xiangya Hospital of Central South University in China.

Course description

We designed 6 major sections for SPOC-based CBL teaching method: 1. Online self-study and pre-class test; 2. Online collection of medical history, positive physical examination sign and auxiliary examination; 3. Group discussion of diagnosis and treatment plan; 4. Online pre-operative communication between student and standard patient (SP); 5. Live broadcast of surgery; 6. Summary (Fig. 1).

In the first part, according to the learning tasks issued online by the teacher, students were required to watch video lectures and PowerPoint presentations related to 12 cases, which were carefully selected from gastrointestinal surgery, hepatobiliary surgery, orthopedics, spine surgery, and urology. Once the students believed that the knowledge in the task list was mastered, no matter how long they had studied, students could take the pre-class test, including multiple-choice questions, true/false questions and fill-in-the-gaps related to the cases. Students needed to maintain a score of more than 80% to enter the next study section.

Three missions were needed to be completed by students in the second section. Firstly, collecting medical history of SPs online. Then, students performed physical examinations on the isolated people in the same house, and teachers assessed the physical examination operations of students and informed of the corresponding results. For instance, if a student wanted to know the lower limb length of the patient in a case, he would need to make a correct measurement on one isolator in the same house, or he cannot get the data of lower limb length. After the physical examination, students could ask for the result of auxiliary examination from teachers and SPs.

The third section is group discussion, which was performed through online conference software. Under the instruction of teachers, students discussed about the diagnosis and treatment based on the information obtained from the previous section. In addition, at the end of the discussion, the teachers corrected the mistakes presented during the discussion.

According to the therapeutic methods proposed in the third section, students informed the SPs of his/her situation and the next treatment plan. If a surgery was needed, students would have a preoperative talk with the SP and give pre-operative advices.

In the fifth section, with the consent of the patients (not SPs), students will watch the live broadcast or recorded videos of the surgeries. The surgeries were performed by qualified doctors. Students needed to describe the purposes, processes, and notes of the surgeries while watching the videos. The teachers recorded the information provided by students and then corrected the mistakes.

In the final step, teachers evaluated the performance of students in previous 5 sections. Then, a post-class test containing 10 questions about the surgery process, complications, and postoperative management was performed.

Data collection

At the end of 12 weeks online teaching, which was also the end of the first semester of 2020, students from each group took a final exam and a questionnaire. Theoretical knowledge, physical examination, clinical operation, medical record writing, and clinical analysis abilities were included in the final exam, 100 points for each aspect. The content of the questionnaire includes the necessity of conducting online internships teaching during pandemic, teaching satisfaction, whether SPOC based CBL could improve the knowledge, clinical thinking and or could replace traditional internships, and whether to keep on online study after the pandemic.

Analysis

The Shapiro-Wilk test was used to test the distribution of individual variables for normality. Paired *t* tests were used to compare the final scores during the pandemic to the corresponding baseline scores before the pandemic of the same students. One-way ANOVA with LSD was performed for analysis among groups. Dunnett T3 test was used to illustrate differences between every two groups. Statistical analyses were performed with IBM SPSS Statistics. A *p* value < 0.05 was considered statistically significant.

Results

Characteristics of participant

108 medical students who were supposed to practiced surgery in the second Xiangya hospital of Central South University and 12 well-trained doctors were enrolled in this study. Basic characteristics of all participants were showed in table 1.

Final test after course

There were statistically significant differences among the 5 aspects of final exam ($P=0.000$). Significant difference between score of clinical operation and other aspects has been demonstrated using Dunnett T3 test ($P=0.000$). (Figure 2) Compared with the traditional teaching before the pandemic, the SPOC-based CBL during the pandemic increased the scores of students in the surgical basic knowledge, clinical analysis ability and medical record writing, but decreased the scores of clinical operative skills and physical examination. There were statistically significant differences in surgical basic knowledge, clinical analysis ability and clinical operative skills. (Table 2)

Questionnaire survey

According to the results of the questionnaire survey of 12 groups of students, 91.6% students thought it was necessary to carry out the online teaching and 88.9% of students were satisfied with this teaching method. Meanwhile, although 77.8% of students deemed that online internship cannot completely replace traditional internship, 97.2% of students recommended combination of the online and offline teaching even after the pandemic. More detailed information was shown in table 3.

Discussion

The outbreak of the COVID-19 was an unpredictable emergency, which had brought unprecedented pressure to intern teaching. However, with the popularization of home computers and smart phones and development of convenient teaching software in China, it was feasible to conduct online teaching^[8]. The great challenge we faced was how to make the good use of online teaching platforms and resources, how to transform the teaching mode, and how to adjust the evaluation system to flexibly carry out the online internship teaching.

The traditional internship teaching mode in China is mostly lecture-based and teacher-centered, in which students receive knowledge passively and interaction is rarely seen. In addition, with the increase of conflict between doctors and patients in China, most of the patients lose their trust in doctors especially the interns^[9]. Therefore, the interns seldom have an opportunity to practise clinical operations on patients in China. To make up for this deficiency, we tried to use CBL teaching mode, which was originated from Harvard Business School in the United States^[7]. It is characterized by case-based discussion, interaction, sharing and thinking, in which students would participate actively. It is more effective for teaching and more suitable for current medical education^[10]. On the other hand, there are also limitations in CBL teaching method. For instance, once the students lack enough basic knowledge, the quality of teaching cannot be guaranteed. Moreover, due to the constraint of space and time, it is difficult to monitor pre-class and post-class study situation in CBL^[11].

Due to the advantages of SPOC, we decided to use SPOC as our online teaching method in this special pandemic period. SPOC is derived from the MOOC, and is implemented on a smaller scale and has more restrictive requirements for entering the curriculum, paying more attention on the quality of teaching compared with MOOC. SPOC is suitable for internship teaching because internship teaching in China is usually conducted in small-scale in which the interns are organized and trained in groups. The characteristics of SPOC can just fill the holes of CBL for internship teaching, especially of online CBL. Therefore, we applied the SPOC-based CBL in surgical intern teaching during the COVID-19 pandemic.

Findings of the questionnaire survey showed that most of the students thought it was necessary to carry out the online internship teaching and were satisfied with SPOC-based CBL. As required by SPOC, students learned the case-related resources by their own before pre-class test, and they could study in their own rhythm, which could help to optimize their use of time^[12]. The pre-class test provided an effective way for evaluating mastery of basic knowledge related to the case, which could overcome the limitation of CBL that it couldn't guarantee the teaching quality when basic knowledge was not well

mastered by students^[13]. As it was shown in the results of questionnaire, 94.4% of students thought this teaching mode was resultful in enhancing theoretical knowledge, and 97.2% of students regarded it as a good way to improve clinical thinking.

The major challenge of online internship teaching was how to improve the capacity in clinical work, including the capability of medical history collection, physical examination, medical record writing, doctor-patient communication, and surgical operation. In this teaching mode, we combined the online training on SP with the offline training on isolators in the same house, aiming to improve the ability of medical history collection, physical examination, and doctor-patient communication. Some researches showed that video coaching and mental practice can improve the operative ability^[14, 15]. So we trained students using live broadcast and videos of surgery, and tried to help them understand and remember the procedures. However, the results of final test revealed that the clinical operative skills in SPOC based CBL was significantly poorer than in traditional surgical internship teaching before the pandemic. This result is consistent with other studies^[16], that surgical skills cannot be improved through video review alone. Because these techniques require practice in operations or at least in simulation training^[17]. Only 57.3% of students believed that online learning alone could improve surgical skills, which highlights the shortcomings of online internship teaching.

Conclusion

The online internship teaching has been developed to overcome difficulties during the COVID-19 pandemic, and also promoted the reform of medical education in China. Compared with the traditional internship teaching, SPOC-based CBL was more effective in stimulating learning interest, improving the efficiency of theoretical learning, and enhancing clinical analysis ability. Although SPOC-based CBL cannot replace the traditional mode completely because of lack of practice in surgical skills, it was a qualified alternative in the COVID-19 pandemic.

Abbreviations

COVID-19

novel coronavirus disease 2019

SPOC

small private online course

CBL

case-based learning

MOOC

derived from Massive Open Online Courses

SP

standard patient.

Declarations

Availability of data and materials

The datasets used in the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This study was performed in accordance with the Helsinki Declaration and was approved by the Second Xiangya Hospital Ethics Committee. The informed consent obtained from study participants was written.

Consent for publication

Not applicable.

Competing interests

None to report.

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Authors' contributions

TH and JC designed the study. JW, XH, KP, XY, DR, WZ acquired the data. JW, HL and HW analysed and interpreted the data. JW drafted the manuscript. YK, ZL, TH and JC revised the final version of the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1. Basic characteristics of all participants.

Variable	Number of people	
	students	doctors
Age	22.29±0.54	35.00±3.16
21-25	108	0
31-35	0	8
36-41	0	4
Gender		
Male	59	12
Female	59	0
Health status		
Health	108	12
With symptoms	0	0

Table 2. Comparison of the results of each part of the final examination (\pm S, points).

	Surgical basic knowledge	Physical examination	clinical operative skills	Medical record writing	Clinical analysis ability
During the pandemic	90.00±4.76	88.89±3.38	79.19±5.52	88.94±3.12	89.55±3.41
Before the pandemic	85.81±7.45	90.22±2.85	85.28±9.45	89.98±2.67	84.57±5.07
<i>t</i>	3.167	1.962	3.381	1.638	4.495
P	0.003	0.058	0.002	0.110	0.000

Table 3. The questionnaire with quantitative questions used for feedback of teaching effect by 108 students.

	Totally (%)	Moderately (%)	A little (%)	Not at all (%)	No opinion (%)
Experience of participants					
Do you satisfy with the effect of online teaching	47.2	41.7	0	0	11.1
Do you think online teaching can improve your knowledge?	55.6	38.9	0	0	5.6
Do you think online teaching can improve clinical thinking skills?	63.9	33.3	0	0	2.8
Do you think online teaching can improve clinical operation skills	19.4	38.9	13.9	5.6	22.2
Opinions to SPOC-based CBL					
Do you think it is necessary to conduct online internships during COVID-19 outbreak?	69.4	22.2	0	0	8.3
Do you think online internships can replace traditional internships?	0	5.6	25.0	52.8	16.7
Do you agree to keep online internships after the pandemic?	75.0	22.2	0	0	2.8

Figures

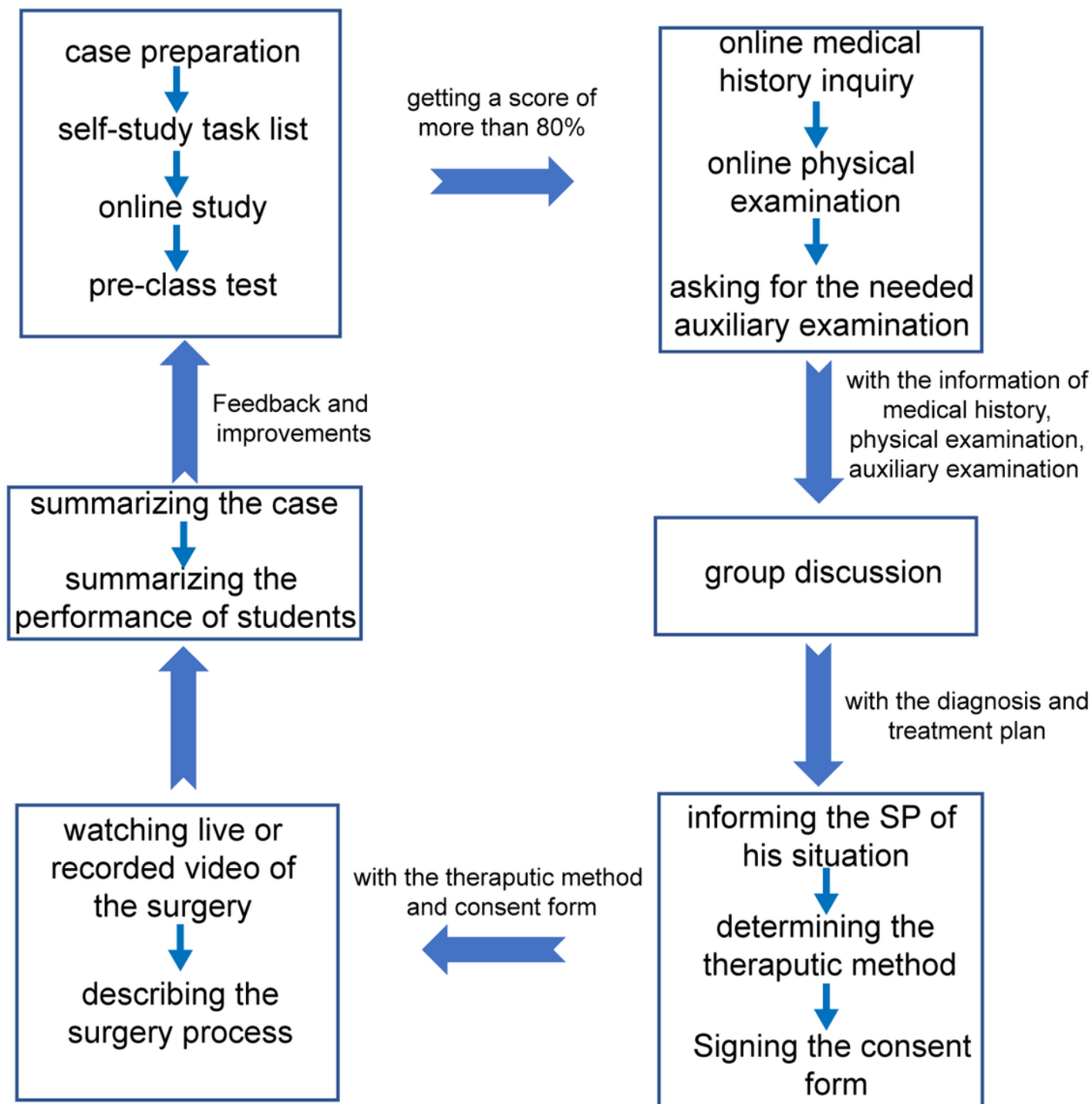


Figure 1

SPOC-based CBL teaching method. It is a loop circle with 6 sections: 1. Online self-study and pre-class test; 2. Online collection of medical history, positive physical examination sign and auxiliary examination; 3. Group discussion of diagnosis and treatment plan; 4. Online communication between student and patient; 5. Live surgery; 6. Summary.

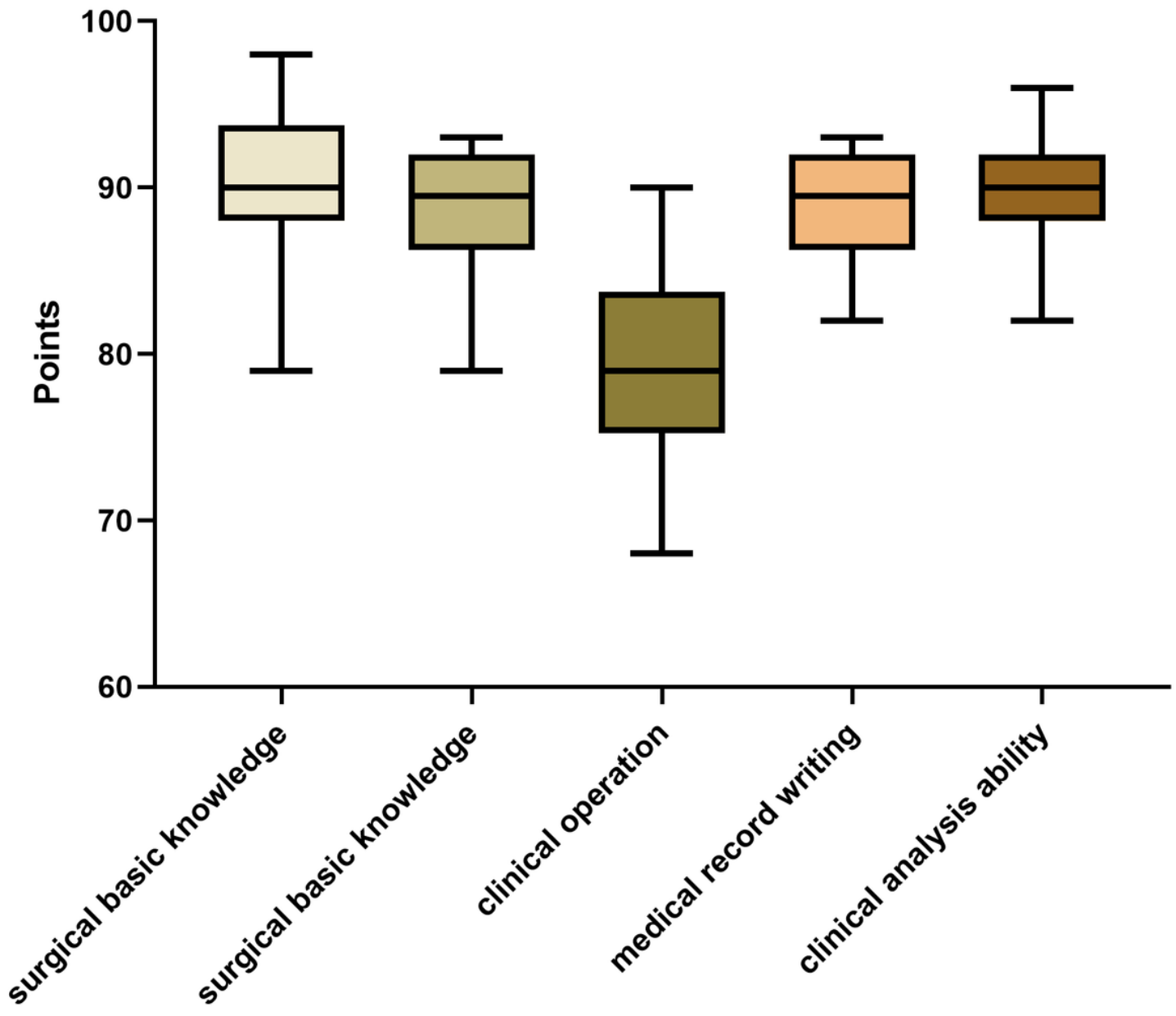


Figure 2

Scores in the final test. There was a significant difference between score of clinical operation and other four aspects.