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## New methods and techniques in interventional cardiology. Evaluation the knowledge of medical students of Jagiellonian University Medical College

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**Abstract:** **Introduction:** Interventional cardiology (IC) is a rapidly expanding field of medicine. Medical studies should provide students the necessary level of knowledge about new techniques in IC. **The aim** of the study was to assess the medical students' knowledge about various new areas of IC. **Material and methods:** Self-designed questionnaire was used to assess student's knowledge. It contained 31 questions. The initial 3 questions concerned general information, the remaining ones were related to different IC techniques: Transcatheter Aortic Valve Implantation (TAVI), Bioresorbable Vascular Scaffold (BVS), percutaneous mitral regurgitation repair methods, Left Atrial Appendage Occlusion (LAAO), Renal DeNervation (RDN), Balloon Aortic Valvuloplasty (BAV) and Atrial Septal Defect/Persistent Foramen Ovale (ASD/PFO). One point for each correct answer was awarded.

**Results:** In our study participated 104 students. Mean score was  $15.9 \pm 5.8$  points. 24% of participants were 3<sup>rd</sup> year students, 38% — 4<sup>th</sup>, 20% — 5<sup>th</sup> and 18% — 6<sup>th</sup>. There was no differences in level of knowledge between students of different years of studies ( $p = 0.2$ ). Students from Students Research Groups (SRG) achieved higher score in comparison with students no attending SRG ( $19.3 \pm 6.3$  vs  $13.3 \pm 3.7$ ;  $p < 0.001$ ) as well as students interested in cardiology comparison with other ( $19.6 \pm 5.9$  vs  $13.0 \pm 3.8$ ;  $p < 0.001$ ). Students from SRG and interested in cardiology reached also higher results in practically every area of IC in comparison with other. **Conclusions:** Participants have insufficient, outdated and incomplete knowledge of new methods in IC. There was no significant difference in students of different years of studies. Students belonging to cardiological SRG and interested in cardiology have greater knowledge in IC.

**Key words:** interventional cardiology, students research groups, survey.

## Introduction

Contemporary cardiology, especially interventional cardiology is a rapidly expanding branch of medicine [1]. Each year, during scientific conferences and in medical journals, there are many reports on new techniques or new applications of already-existing. Nowadays development of interventional cardiology is multi-directional. Techniques which can be used to treat structural valvular diseases (aortic stenosis and mitral regurgitation) develop particularly intensively [1]. Furthermore, this dynamic development will be constantly observed [2]. According to World Health Organisation (WHO), cardiovascular diseases along with neoplasms will continue to be the main causes of morbidity and mortality. Therefore, the demand for new and better treatment methods will increase. The development of a particular field of medicine must be accompanied by continuous progress of the teaching methods, including updating the scientific books and other sources of knowledge. Medical students should be provided with reliable and up-to-date knowledge. This is also important for the continuous development of the interventional cardiology. Well-educated students will provide adequate staffing facilities to ensure further progress in interventional cardiology in the future. In order to make the most accurate and meaningful assessment of appropriate development of teaching, it is necessary to examine students' knowledge.

The level of awareness of medical students about new methods in interventional cardiology has not been thoroughly analyzed yet. Results from similar studies, mainly regarding interventional radiology [3–7], confirm the initial assumption that the level of this knowledge is insufficient. The aim of the study was to assess the level of knowledge of medical students about new methods in interventional cardiology.

## Material and methods

The students' knowledge was assessed using a specially prepared self-designed questionnaire. It consisted 31 questions. The initial 3 questions were related to general information: year of studies, belonging to the cardiological students research groups (SRG) and interest in cardiology in the future. Another 28 questions checked knowledge of the following fields of interventional cardiology: Transcatheter Aortic Valve Implantation (TAVI) — 5 questions, Bioresorbable Vascular Scaffold (BVS) — 3 questions, percutaneous mitral regurgitation repair methods, Left Atrial Appendage Occlusion (LAAO), Renal DeNervation (RDN), Balloon Aortic Valvuloplasty (BAV) and Atrial Septal Defect/Persistent Foramen Ovale(ASD/PFO) (in each 4 questions). We awarded 1 point for each of these questions. The maximum possible score was

28 points. All questions based on current knowledge. Additionally, all questions were evaluated by experts in specific areas.

The survey has been made available to the participants through online student forums. All submissions were anonymous. Students were given to provide the responses from 23rd February 2017 to 31st March 2017.

The study protocol was approved by the local ethics committee (Consent No. 122.6120.36.2017). The participants gave the informed voluntary consent to take part in the study and to use their results in further analyzes.

### Statistical analysis

Standard descriptive statistics were used in the analysis. Quantitative variables were described using mean and standard deviation. Categorical variables were presented as counts and percentages. The chi-squared test was used to evaluate the correlation of qualitative data whereas t-student and Kruskal-Wallis tests for quantitative data. For all tests, the p value  $<0.05$  was considered as statistically significant. All analyses were carried out with Statistica 12 (StatSoft, Inc. Tulsa, OK, USA).

### Results

104 students of the Jagiellonian University Medical College, who responded to the study invitation placed on the internet student forums were included to the study. The average score for all participants was  $15.9 \pm 5.8$ . Only students who started clinical classes and went through the basic science (from the third to the sixth year) were qualified (Fig. 1).

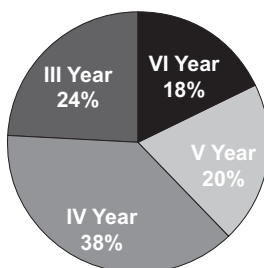


Fig. 1. Participation of persons from different years of study in the study group.

Comparing the results obtained by students of each year, a gently inclined learning curve was observed both in case of the total end result (Fig. 2) and in particular interventional cardiology domains (Fig. 3). This result, however, did not reach statistical significance ( $p = 0.2$ ).

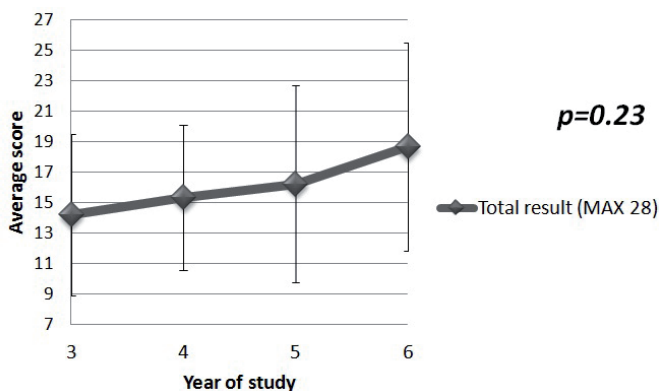
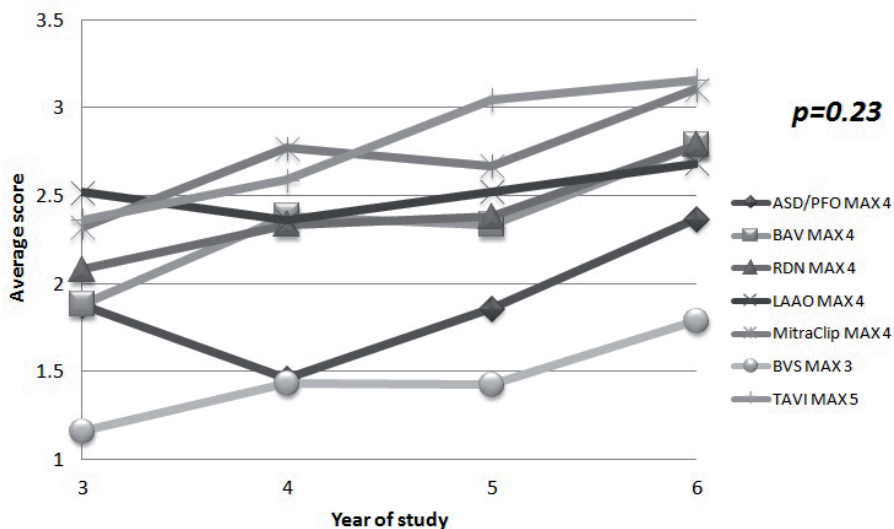


Fig. 2. Mean results from total test obtained by students from particular years of studies.



ASD/PFO — Atrial Septal Defect/Persistent Foramen Ovale, BAV — Balloon Aortic Valvuloplasty, BVS — Bioresorbable Vascular Scaffold, LAAO — Left Atrial Appendage Occlusion, Percutaneous MR repair methods — Percutaneous mitral regurgitation repair methods, RDN — Renal DeNervation, TAVI — Transcatheter Aortic Valve Implantation

Fig. 3. Mean results from particular chapters obtained by students from particular years of studies.

Continuing the analysis, participants were divided into two groups: members (45 people, 43.3%) and non-members (59 people, 56.7%) of cardiological SRG present at our University. Students who are engaged in the work of the SRGs have a much wider knowledge of new methods in interventional cardiology and scored higher result ( $19.3 \pm 6.3$  vs  $13.3 \pm 3.7$ ;  $p < 0.001$ ) (Table 1).

**Table 1.** Comparison of outcomes of students who belong and do not belong to the cardiological Student Research Groups.

	<i>Members</i>		<i>Non-members</i>		p value
	Average value	SD	Average value	SD	
Total result	19.3	6.3	13.3	3.7	< <b>0.001</b>
ASD/PFO	2.5	1.3	1.3	1.1	< <b>0.001</b>
BAV	2.6	1.2	2.1	0.9	< <b>0.007</b>
RDN	2.9	1.3	2.0	1.1	< <b>0.001</b>
LAAO	2.9	0.9	2.2	1.0	< <b>0.001</b>
Percutaneous MR repair methods	2.9	1.1	2.5	1.0	0.060
BVS	2.0	1.0	1.0	0.9	< <b>0.001</b>
TAVI	3.5	1.5	2.1	1.1	< <b>0.001</b>

ASD/PFO — Atrial Septal Defect/Persistent Foramen Ovale, BAV — Balloon Aortic Valvuloplasty, BVS — Bioresorbable Vascular Scaffold, LAAO — Left Atrial Appendage Occlusion, Percutaneous MR repair methods — Percutaneous mitral regurgitation repair methods, RDN — Renal DeNervation, SD — standard deviation, TAVI — Transcatheter Aortic Valve Implantation.

The intention of binding the professional future with cardiology was another criterion for the division of students involved in the study. Participants planning to specialize in this field of medicine (45 people, 43.3%) also responded significantly better than others (59 people, 56.7%) —  $19.6 \pm 5.9$  points vs  $13.0 \pm 3.8$  points ( $p < 0.001$ ) (Table 2).

**Table 2.** Comparison of student outcomes in terms of binding their future with cardiology.

	<i>Binding</i>		<i>Non-binding</i>		p value
	Average value	SD	Average value	SD	
Total result	19.6	5.9	13.0	3.8	< <b>0.001</b>
ASD/PFO	2.5	1.2	1.3	1.0	< <b>0.001</b>
BAV	2.7	1.1	2.0	0.9	< <b>0.001</b>
RDN	2.8	1.3	2.0	1.1	< <b>0.001</b>
LAAO	3.0	0.9	2.1	0.9	< <b>0.001</b>
Percutaneous MR repair methods	3.0	0.9	2.4	1.1	<b>0.004</b>
BVS	2.0	1.0	1.0	0.9	< <b>0.001</b>
TAVI	3.5	1.4	2.2	1.2	< <b>0.001</b>

ASD/PFO — Atrial Septal Defect/Persistent Foramen Ovale, BAV — Balloon Aortic Valvuloplasty, BVS — Bioresorbable Vascular Scaffold, LAAO — Left Atrial Appendage Occlusion, Percutaneous MR repair methods — Percutaneous mitral regurgitation repair methods, RDN — Renal DeNervation, SD — standard deviation, TAVI — Transcatheter Aortic Valve Implantation.

Subsequently, the results concerning the particular techniques of interventional cardiology were compared. Almost in every case, the students belonging to SRGs presented significantly better knowledge of specific technique (Table 1).

Similar results have been observed for participants who want to bind their future with cardiology — for each technique their knowledge was significantly better than other participants (Table 2).

## Discussion

Interventional cardiology as a dynamically developing field of medicine encounters a number of challenges. At the base of this development lies the education at medical schools based on current knowledge. It is important to adapt the curriculum to current guidelines in order to increase the level of awareness of students and young doctors. They may be a group of future interventional cardiologists who will create the development of this branch of medicine. For this reason it is important to supervise current level of knowledge at the academic level and to compare it with the results presented in similar analyzes.

Our study confirmed that the knowledge of Polish medical students about new methods used in interventional cardiology is not satisfactory. The average score from our authorial test was only  $15.9 \pm 5.8$ . This represents 56.8% of correct answers.

The scale of the problem has not been thoroughly analyzed yet. Data from other publications confirm that this problem is widespread and does not concern only Polish medical schools [3, 4, 7].

An important parameter often used in medical didactics is the learning curve. This is a graphical representation of the increase in knowledge and skills with the passage of time and with gradual gaining experience [8]. The correct shape of the learning curve is precisely defined. It should be characterized by rapid initial growth that demonstrates continuous improvement and knowledge acquisition. Subsequently, it should become flattened, indicating that knowledge or skills are stable at the best possible level. When the whole group is analyzed with it, the curve shows the average group's knowledge acquisition process. The learning curve is most often used to describe the process of acquiring practical skills [8–10]. Nevertheless, in our work we decided to present it — its creation often facilitates the understanding of the observed problem.

In our research the learning curve illustrates the results obtained by students of consecutive years of medical education. Using the curve, we presented both total results (Fig. 2) and results from specific new techniques of interventional cardiology (Fig. 3). The plotted curves deviate from the correct shape described above. They are slightly sloping throughout their course and, as a result, differences between subsequent years are not statistically significant ( $p = 0.2$ ). These curves show that

the process of gaining knowledge during medical studies is not dynamic enough. Therefore, specific actions accelerating this process are necessary.

One of possible solutions is the active participation of students in SRGs. Our research has shown that SRGs play an important role in gaining knowledge about new techniques in interventional cardiology. Undoubtedly, they are an important part of medical studies. These conclusions have been frequently confirmed in other studies. According to them, students working in SRGs and conducting research obtain many advantages. First and one of the most important benefits is widening their knowledge and developing skills. According to the literature, students who devote their time to scientific research learn the correct principles of conducting such activities and they can review the literature properly [11–14]. Participation in research projects also motivates them to expand their knowledge permanently on their own. Students who belong to SRGs emphasize the great didactic value of such activity [11, 15, 16]. This has been also confirmed in our study. Another important advantage is the high impact of SRGs on the further development of students. Many studies highlight the direct impact of SRGs on choosing a specific career path by students. According to these studies, active students have a larger chance to start intended specialization [14, 17–20]. At this point we would like to emphasize that in our study all students belonging to SRGs combine their future with cardiology. Medical students treat SRGs as the way to achieve their goals. Moreover, membership in the SRGs is very positively assessed by the students. It is a source of satisfaction and makes medical studies much more interesting for them [14, 15]. All from the above observations have been collected by Bierer *et al.* in a review of the literature concerning this issue [21]. Despite many advantages, medical schools put different emphasis on students' research. One of the most frequently mentioned problems in literature are difficulties in conducting research by students and lack of access to appropriate resources [21]. At our University there are a lot of SRGs, including many related to cardiology. In our opinion, the SRGs should be further developed and supported by the University authorities to encourage as many students as possible to engage and become involved in that type of activity. Most students are interested in expanding their knowledge of interventional cardiology. This is a huge potential which should be utilized. Introduction of innovative teaching methods is another way to improve awareness of new techniques in interventional cardiology. A very interesting option are appropriate medical simulations, as well as e-learning methods [6, 22].

### Limitations

The limitation of our study is the relatively small study population. All participants qualified for the study were medical students from only one University. Therefore, the results presented above might not apply to students of other medical schools.

The number of questions we have included in the questionnaire was limited. However, we have tried to make sure that evaluation the knowledge of students is as correct as possible.

## Conclusions

The study has shown that medical students have insufficient, outdated and incomplete knowledge of new methods used in the intensively developing interventional cardiology. There were no statistically significant differences between participants of different years of studies. Whereas students belonging to the cardiological SRGs and binding their future with cardiology were statistically more knowledgeable than those not interested in this field of medicine.

The study shows that changes in the curriculum based on the latest recommendations and considering the dynamic of development of this branch of medicine are necessary. The further development of the SRG network in each of the medical schools seems to be desirable.

What our study points, the SRGs create conditions for developing and deepening knowledge for students interested in cardiology in the future.

## Acknowledgments, funding and disclosures

None.

## Conflict of interest

None declared.

## Abbreviations

ASD/PFO	— Atrial Septal Defect/Persistent Foramen Ovale
BAV	— Balloon Aortic Valvuloplasty
BVS	— Bioresorbable Vascular Scaffold
LAO	— Left Atrial Appendage Occlusion
Percutaneous MR repair methods	— Percutaneous mitral regurgitation repair methods
RDN	— Renal DeNervation
SD	— standard deviation
SRG	— Student Research Group
TAVI	— Transcatheter Aortic Valve Implantation



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