THE BASIC LAPAROSCOPIC SKILLS LONG-TERM SURVIVAL: NEW PREDICTION SCALE

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Abstract

Introduction: The most important principle of pedagogy, including medical, is to correctly assess the knowledge and skills acquisition since they must be restored during the study and retained for use in further professional practice.

Knowledge and skills in time survival are of particular importance in medicine since its determination allows to reveal the necessary time for repeated training and evaluate in general the medical education system efficiency.

Objective: To develop a scale for predicting basic laparoscopy skills long-term survival in the medical education system.

Materials and methods: The training results and assessment of 48 Odessa National Medical University medical students have been studied with the use of basic laparoscopy skills module of 3-D laparoscopy simulator trained as part of this module at the 5th year, forming a comparative group - CG (for obtaining initial mathematical prediction indicators), repeated it at the 6th year - forming the main group - MG (this group for the knowledge survival calculations and for reaching the main goal). They have passed all the module tasks, at least 10 trainings per module with the number of repetitions from 1 to 4. Time was recorded for the practical skills, security parameters, visual-motor coordination, the selection and release of devices, pedaling, diathermy, aspiration, irrigation, with a video camera viewing angle of 30° and 0°.

The definition of the initial (1st training), intermediate (5th training) and the final (10th training) level of the CG and the MG students practical skills during two years of training, forming 6 groups accordingly, using the self-assessment coefficient (SAC) of the trainee, developed by us on the questionnaires and the practical skills coefficient (PSC) based on the evaluation sheets was determined, summarized and generalized for each group. The Lykert 6-point scale (0-5) of competence levels total assessments were used.

Results: All questionnaires, evaluation sheets, and SACs were specifically developed by us for a specific virtual laparoscopic simulator. SAC was calculated by dividing the total number of points obtained by questioning the maximum possible number of points (50 points). The PSC was calculated by dividing the total number received by the instructor from the exact stage of each student on the maximum possible number of points (70 points). The received SAC and PSC for each student in each of the six stages were summed up with each other and divided into two, obtaining the resultant coefficient of practical skills (RCPS).

The highest rates of practical skills were in the students of the MG final ($p < 0.05$ to both MG initial and intermediate) and CG final ($p < 0.05$ for both CG initial and intermediate), i.e. all students at the end of the 10th training both 1st and 2nd year. The laparoscopy skills long-term survival scale calculation showed a high correlation of indicators in comparable groups. The survival of skills depends on the number of trainings conducted

Conclusions:

1. PSC is of great importance for laparoscopic skills assessment.
2. The SAC effectively process a large array of questionnaires, together with PSC, by obtaining the RCPS - more accurate practical skills evaluation.

3 The survival scale provides an opportunity to assume the long-term ability of the acquired laparoscopic skills with the optimum acquisition at the end of the simulation training of the RCPS not less than 0.65.

Keywords: Basic laparoscopic skills, medical education, assessment, evaluation, laparoscopic gynecology, laparoscopic surgery, 3-D application, practical skills survival.

1 INTRODUCTION

Of particular interest to any creative teacher is the question of which teaching methods are most modern and effective. With traditional medical training, various flaws are identified. First of all, this is the inability to apply the acquired knowledge in practice, the formality of this knowledge, the insufficient formation of clinical thinking, the inability to build communication with patients and colleagues. According to the literature, only 10% of the teaching material stated aloud is assimilated, respectively, the knowledge to be assimilated, with less efficiency, can be transferred in the finished form by message or display.

Therefore, recently, simulation training, active teaching methods in practical classes have gained wider use [1]. From 2014, in Odessa, the first Educational and Innovation Center for the Physicians Practical Training and the first Department of Simulation Medicine (academic department in Ukraine) were created in our country, which widely use innovative methods of theoretical and practical training on robots and simulators of the latest generation, psychological trainings and questioning [2,3].

The most important principle of pedagogy, including medical, is to correctly assess the acquisition of knowledge and skills, because they should be restored during studies and preserved for use in further professional practice [4, 5]. The survival of knowledge and skills over time is of particular importance in simulation training methods, because its determination allows you to identify the necessary time for repeated trainings and generally evaluate the system of simulation education.

In medical education, when assessing and determining effectiveness, indicators can be used that are defined in the general pedagogical process (for example, the coefficient of academic achievement [6], the practical skills coefficient (PSC), and the long-term survival rate of knowledge (LTSRK [6, 7]). Their weak side is that the application is one-sided assessment - or only the student's self-esteem during the survey, or only practical results, and the existing methods for assessing the survival of knowledge are also one-sided - most often this is a survey list (self-esteem) [6, 8, 9].Typically, to determine the LTSRK, a comparative analysis of the survival of knowledge is carried out by testing six months after the first training period [6, 7]. According to the literature, it is considered to be a positive result of the survival of knowledge and skills with a LTSRK of ≥0.50 [6, 8].

To calculate the PSC, all points accumulated are added up and divided by the maximum possible number of points [8]. Thus, the highest coefficient of practical skills corresponds to one. Acceptable, according to the recommendations of the manufacturer and generally accepted world practice, the coefficient of practical skills is not less than 0.7 [6, 8].

We have not found in the accessible literature a more universal method for identifying the long-term survival of knowledge, which would use both subjective and objective indicators, questionnaires, and computer testing. It was decided to study summarizing indicators for this purpose, aimed at calculating the contents of the questionnaires and directly the results of mastering practical skills on modern computerized virtual simulators of the latest generation.

Our goal was to develop a scale for predicting the long-term survival of practical skills in the system of medical simulation education.

2 METHODOLOGY

For the study, the results of simulation training in 2014-2017 were taken for 48 students of Odessa National Medical University at the Department of Obstetrics and Gynecology, at the Educational and Innovation Center for the Physicians Practical Training and at the Department of Simulation Medicine. They were trained using a virtual endoscopic simulator.

The module (course) "Basic laparoscopic skills" in general laparoscopic surgery was taken as the basis. We used the LapMentor simulator (3D Systems, USA), which allows real-time feedback from the student, the haptic, to be implemented. All 48 students underwent training in the framework of this module at the 5th year forming a comparative group (to obtain initial indicators of mathematical

forecasting), repeated it at the 6th year - forming the main group (this group is for calculating knowledge survival and for achieving the main goal). Accordingly, they formed the CG and MG groups. They were trained in the volume of all tasks (practical skills) of the module, at least 10 trainings per module. The number of repetitions of each practical skill for the module period varied from 1 to 4, depending on the expected result. The time taken to complete the practical skill, safety parameters, hand-eye coordination, device selection and release, working with pedals, diathermy, aspiration, irrigation, and a video camera with a viewing angle of 30 ° and 0 ° were recorded.

To achieve this goal, two tasks were solved. First of all, it is assessment, determination of the initial (1st training), intermediate (5th training) and final (10th training) level of practical skills of CG and MG students during 2 years of training. According to these three assessments, 6 groups were obtained during all the years of study: CG preliminary, CG interim, CG final, MG preliminary, MG interim, MG final. In all groups, the student's self-assessment coefficient (SAC) developed by us was determined by questionnaires and practical skills coefficient (PSC) by score sheets in each group. A summation of the obtained coefficients was carried out and general assessment indicators were obtained for each group. The second task was to develop a prognostic scale for the survival of practical skills for 2 years after the first trainings after processing and discussing the results. We used a 6-point scale (0-5) of total assessments of Lykert competency levels. Statistical processing was performed using Statistics 6.0 and Microsoft Excel 2010 for Windows.

3 RESULTS

All questionnaires (evaluation lists), assessment lists, and self-assessment coefficient (SAC) were specially developed by us for the simulation training conducted at our Center and Department on a specific virtual simulator. The questionnaires and evaluation sheets developed by us during the study are given below (see tables 1, 2, 3).

Table 1. Preliminary student profile.

Module "Basic laparoscopic skills. " LapMentor

Name _____Date _____Gender _____Dominant hand _____

№	Question	Self-assessment	Points
1.	How do you assess your current level of theoretical knowledge and skills of open surgery.	no answer	0
		very weak	1
		weak	2
		average	3
		good	4
		perfect	5
2.	How much do you assess your suturing and knotting skills in open surgery?	no answer	0
		very weak	1
		weak	2
		average	3
		good	4
		perfect	5
3.	How long have you been involved in open operations as an observer?	not involved	0
		< 1 hour	1
		1-2 hours	2
		2-3 hours	3
		3-4 hours	4
		> 4 hours	5

4.	What is your experience with suturing and knotting in open surgery?	No experience	0
		< 1 hour	1
		1-2 hours	2
		2-3 hours	3
		3-4 hours	4
		> 4 hours	5
5.	How do you evaluate your skills of knotting with two hands on the tissue without tension during open operations?	no answer	0
		very weak	1
		weak	2
		average	3
		good	4
		perfect	5
6.	How do you assess your knitting skills with one hand on the tissue without tension during open operations?	No experience	0
		very weak	1
		weak	2
		average	3
		good	4
		perfect	5
7.	Have you had any experience with a laparoscopic trainer?	No experience	0
		< 1 hour	1
		1-2 hours	2
		2-3 hours	3
		3-4 hours	4
		> 4 hours	5
8.	Have you had any experience with a laparoscopic simulator?	No experience	0
		< 1 hour	1
		1-2 hours	2
		2-3 hours	3
		3-4 hours	4
		> 4 hours	5
9.	How long have you been involved in laparoscopic surgery as an observer?	not involved	0
		< 1 hour	1
		1-2 hours	2
		2-3 hours	3
		3-4 hours	4
		> 4 hours	5
10.	How do you assess your current level of theoretical knowledge and skills of laparoscopic surgery.	No experience	0
		very weak	1
		weak	2
		average	3
		good	4
		perfect	5
Total points			
Self-assessment coefficient (SAC) (TOTAL/50=)			

The initial (preliminary) questionnaire was filled out by the self-taught before his first training, the final - after the last (10th) training, the intermediate - before the fifth (the form of the final questionnaire was used, see Table 2.).

Table 2. Final student profile.

Module "Basic laparoscopic skills. " LapMentor

Name _____Date _____Gender _____Dominant hand _____

№	Question	Self-assessment	Points
1.	How do you assess your current level of theoretical knowledge and skills of laparoscopic surgery.	no answer	0
		very weak	1
		weak	2
		average	3
		good	4
		perfect	5
2.	Have your knowledge and practical skills improved after simulation training?	no	0
		very weak	1
		weak	2
		average	3
		good	4
		significantly	5
3.	How easy was it to pass the qualification level “moving pegs”?	do not pass	0
		very hard	1
		hard	2
		average	3
		simple	4
		very simple	5
4.	How easy was it to pass the qualification level “cutting according to the pattern”?	do not pass	0
		very hard	1
		hard	2
		average	3
		simple	4
		very simple	5
5.	How easy was it to pass the qualification level “endoscopic loop”?	do not pass	0
		very hard	1
		hard	2
		average	3
		simple	4
		very simple	5

6.	How easy was it to pass the extracorporeal suturing qualification level?	do not pass	0
		very hard	1
		hard	2
		average	3
		simple	4
		very simple	5
7.	How easy was it to pass the qualification level "intraracorporeal suturing"	do not pass	0
		very hard	1
		hard	2
		average	3
		simple	4
		very simple	5
8.	Have your practical skills with laparoscopic instruments improved after simulation training?	no	0
		very little	1
		little	2
		average	3
		good	4
		significantly	5
9.	Have your practical skills of working with a laparoscopic video camera improved after simulation training?	no	0
		very little	1
		little	2
		average	3
		good	4
		significantly	5
10	How comfortable you currently feel as an observer in laparoscopic surgery.	no answer	0
		very uncomfortable	1
		little comfortable	2
		average	3
		comfortable	4
		more than comfortable	5
Total points			
Self-assessment coefficient (SAC) (TOTAL/50=)			

SAC was calculated by dividing the total number of points obtained during the survey by the maximum possible number of points (in these profiles - 50 points). If a student received only 25 points during self-assessment, then, accordingly, SAC was 0.5 for this survey (TOTAL / 50 = 0.5). The preliminary assessment sheet was filled out by the instructor after the end of the 1st training, the final - after the last (10th) training, the intermediate - after the 5th training (the same form of the assessment sheet was used, see Table 3).

Table 3. Evaluation profile.

Module "Basic laparoscopic skills." LapMentor

Name _____Date _____Gender _____Dominant hand _____

№	Question	Performance	Points
1.	The choice of instrument, camcorder, its viewing angle	wrong	-5
		right	5
2.	The time for the "transfer of pegs" (detected from the moment of capture of the first element)	> 5 min.	-5
		4,5-5 min.	1
		4-4,5 min.	2
		3,5-4 min.	3
		3-3,5 min.	4
		<3 min.	5
3.	Errors in the "transfer of pegs"	All not transfered	-5
		20% transfered	1
		20-40% transfered	2
		40-60% transfered	3
		60-99% transfered	4
		All transfered	5
4.	Time for “cutting according to the pattern" (it is detected from the moment the grid is captured)	> 5 min.	-5
		4,5-5 min.	1
		4-4,5 min.	2
		3,5-4 min.	3
		3-3,5 min.	4
		<3 min.	5
5.	Errors, areas of penalty squares when “cutting by pattern”	All penalty squares captured	-5
		80% penalty squares captured	1
		60-80% penalty squares captured	2
		40-60% penalty squares captured	3
		less t40% penalty squares captured	4
		no mistakes	5
6.	Time to complete the “endoscopic loop” (detected from the moment both instruments appear in the field of view)	> 3 min.	-5
		2,5-3 min.	1
		2-2,5 min.	2
		1,5-2 min.	3
		1-1,5 min.	4
		<1 min.	5
7.	Errors of execution of the “endoscopic loop” (at a distance from the indicated lines)	> 20 мм	-5
		15-20 мм	1
		10-15 мм	2
		5-10 мм	3
		Up to 5 мм	4
		right on line	5

8.	Time for "extracorporeal suturing" (timed from the moment both tools appear in the field of view)	> 3 min.	-5
		2,5-3 min.	1
		2-2,5 min.	2
		1,5-2 min.	3
		1-1,5 min.	4
		<1 min.	5
9.	Errors of performing "extracorporeal suturing" (at a distance from the edge indicated by dots)	> 20 мм, sectional pass	-5
		15-20 мм	1
		10-15 мм	2
		5-10 мм	3
		До 5 мм	4
		Accurately marked points	5
10.	Time for "intracorporeal suturing" (timed from the moment both tools appear in the field of view)	> 10 min.	-5
		9-10 min.	1
		8-9 min.	2
		7-8 min.	3
		6-7 min.	4
		<6 min.	5
11	Errors in the implementation of "intracorporeal suturing" (at a distance from the edge indicated by dots)	> 20 мм, sectional pass	-5
		15-20 мм	1
		10-15 мм	2
		5-10 мм	3
		До 5 мм	4
		Accurately marked points	5
12.	Surgical suture safety	Unsafe (sliding, spreading, etc.)	-5
		safe	5
13.	Camera control (angle 0 °)	wrong	-5
		right	5
14.	Camera control (angle 30 °)	wrong	-5
		right	5
Total Points			
Practical skills coefficient (PSC) (TOTAL/70=)			

The PSC was calculated by dividing the total number of points obtained when the instructor assessed this student at this stage by the maximum possible number of points (in the score sheets we developed, this is 70 points). If a student received only 35 points when evaluating, then, accordingly, the PSC was 0.5 for this case (TOTAL / 70 = 0.5).

The obtained SAC and PSC for each student at each of the six stages (initial, intermediate and final in the 1st and 2nd year of study) were summarized with each other and divided into two. The result was a resultant coefficient of practical skills (RCPS).

Then RCPS was calculated for each group of each stage (for all six groups of the 1st and 2nd year of study), which was used in the main calculations and discussions, comparisons of groups with each other.

After processing the obtained data for each group (according to the calculated by the RCPS), it was revealed that the students of CG final group ($p < 0.05$ compared with CG preliminary and CG interim) and MG final ($p < 0.05$ compared with MG preliminary and MG interim), i.e. all students at the end of the 10th training and the 1st and 2nd year of study (see table 4.)

Table 4. Indicators of the resultant coefficient of practical skills in the studied groups (M ± m, n = 48).

	CG preliminary	*CG interim*	*CG final*	*MG preliminary*	*MG interim*	*MG final*
RCPS	0,12 ± 0,1	0,32 ± 0,1	0,69 ± 0,1	0,52 ± 0,1	0,69 ± 0,1	0,90 ± 0,1

Note: the differences between the indicators of groups of different years of study (MG and CG) and different stages of assessment (initial, intermediate and final) are significant ($p < 0.05$).

Then we calculated a practical scale for the long-term survival of practical skills. The basis for it was the indicators of RCPS in the groups of the second year of study (MG) and the relationship between these coefficients in different periods and stages of training. A high correlation of indicators in comparable groups was noted.

This made it possible to assume that the survival of skills depends on the number of trainings held (the required value is at least 0.65 at the end of the trainings, i.e., in the MG final), which made it possible not to lose significantly practical skills during the year (RCPS decreased in total only up to 0.52, i.e., within the framework of acceptable survival) and achieve rapid growth of skills during 5 and 10 subsequent trainings ((RCPS increased to 0.9, i.e. there remains a high survival rate of skills for the next year and this will give the opportunity at the end of the 6th course to continue learning laparoscopic surgery internship, not only by simulation techniques, but also in the operating room).

4 CONCLUSIONS

1 The coefficient of practical skills is of great practical importance for assessing the implementation of practical skills in simulation training.

2 The self-assessment coefficient obtained as a result of this work makes it possible to efficiently process a large array of questionnaires during simulation trainings and, together with the coefficient of practical skills, by obtaining the resultant coefficient of practical skills, makes it possible to more accurately evaluate practical skills during simulation trainings.

3 The resulting survival rate of practical skills makes it possible to assume the long-term skills gained.

4 Optimal for the long-term survival of practical skills is the trainee receiving at the end of the course of simulation training the resultant coefficient of practical skills of at least 0.65.

5 Obtaining by the trainees at the end of the course of simulation training the resultant coefficient of practical skills less than 0.65 does not give long-term survival of practical skills.

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