10 - ORIGINAL ARTICLE
TECHNICAL SKILL

Chest drainage teaching and training for medical students. Use of a surgical *ex vivo* pig model[1]

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ABSTRACT

PURPOSE: Implement a constructivist approach in thoracic drainage training in surgical *ex vivo* pig models, to compare the acquisition of homogeneous surgical skills between medical students.

METHODS: Experimental study, prospective, transversal, analytical, controlled, three steps. Selection, training, evaluation. Inclusion criteria: a) students without training in thoracic drainage; b) without exposure to constructivist methodology. 2) Exclusion criteria: a) students developed surgical skills; b) a history of allergy. (N = 312). Two groups participated in the study: A and B. Lecture equal for both groups. Differentiated teaching: group A, descriptive and informative method; group B, learning method based on problems. A surgical *ex vivo* pig model for training the chest drain was created. Were applied pre and post-test, test goal-discursive and OSATS scale.

RESULTS: Theoretical averages: Group A = 9.5 ± 0.5; Group B = 8.8 ± 1.1 (p = 0.006). Medium Practices: Group A = 22.8 ± 1.8; Group B = 23.0 ± 2.8 (p <0.001).

CONCLUSION: Through the constructivist methodology implemented in the thoracic drainage training in surgical **ex vivo** pig models, has proven the acquisition of surgical skills homogeneous compared among medical students.

Key words: Thoracostomy. Models, Animal. Training.

Introduction

The teaching of surgical technique is traditionally conducted as a pupil learning[1] just after graduation or during residency, with few previous training opportunities and without a pedagogically structured methodology that objectively establishes parameters for the learning and training process and the development of surgical skills acquired by students.

Surgical training in medical graduation faces difficulties: the confrontation by the use of cadavers with learning purposes[2]; ethical constraints regarding use of the patient as a source of learning[3] and the use of living animals for experimentation, besides the acquisition, use and maintenance of sophisticated models and simulators that represents high costs for the academic institutions are factors that limit the development of student's surgical skills.

Nevertheless, studies report isolated experiences in which is admitted that the use of simulation for an early surgical learning and training process in graduation as a good alternative that could be offered to the student in order to acquire dexterity and abilities[4,5].

The present study intended to implement a constructive methodology grounded in the use of surgical ex vivo pig model, on the learning and training process of drainage thoracic, in order to prove the acquirement of knowledge and the development of uniform and satisfactory surgical skills between students from the initial semesters, similar to those demonstrated by students from advanced semesters on the medical course of Federal University of Pernambuco (UFPE), when compared.

Methods

This research was part of a Master's degree project approved by the Research Ethics Committee in Human Being from Health Sciences Center, Universidade Federal de Pernambuco, obtaining a Certificate of Presentation for Ethics Appreciation (CAAE, in Portuguese initials) N°: 40608215.0.0000.5208.

Experimental, prospective, transversal, analytic, and controlled study, conducted in three phases: selection, learning and training process, evaluation.

Phase 1: Selection

Study population

The curricular profile of the medical course from UFPE was analyzed to determine the subjects with surgical content compatible with the Project, two were identified and selected: 1) Fundamentals of Medical Practice Subject, from the second semester, 2) Fundamentals of High Complexity Health Attention II Subject, from the eighth semester.

Sample selection

Once determined the population of the study, the following selection criteria was applied:

a) Inclusion criteria

1) Medical students without previous experience in the execution of drainage thoracic using a surgical ex vivo pig model;

2) Students without previous exposition to the constructive methodology for the learning and training process of drainage thoracic.

b) Exclusion criteria

1) Students with developed surgical skills for drainage thoracic;

2) History of allergies to biological tissues, materials or inputs used.

The initial population was 332 students: 125 from the second semester (Group "A") and 187 from the eighth semester (Group "B").

Twenty students were excluded: 04 had an allergy to latex and talcum from the gloves; 01 presented phobias to blood and animal tissues; 05 were monitors in surgical subjects from the medical course and 10 were volunteers in emergency services and had already trained the drainage thoracic procedure.

Finally, the sample was formed by 312 students (n = 312).

Phase 2: Learning and training process

Theoretical teaching method

A class about thoracic trauma and drainage thoracic was ministered to both groups, "A" and "B"; exposing the subject fundamental, and highlighting the step by step of the drainage thoracic procedure as described in the ATLS manual[6].

The level of deepening of the lesson and the approach of the subject were different. For group A, a descriptive and informative method was used, stimulating the newly entered on the medical course student's own curiosity; while, for group B, the class had a practical approach, using the problem-based learning (PBL) method. Clinical cases were presented which allowed the students to make correlations between the theory knowledge exposed and the drainage thoracic procedure as a solution to the case.

Practice methodology

The groups were divided into five subgroups of 12 students, receiving a demonstrative class of biosecurity (handwashing, asepsis and antisepsis, management of surgical instruments and needle stick material, management and disposal of biological parts) that took part before the beginning of training.

Two subgroups from group A were trained on the first day of the week and two subgroups from group B were trained on the following day. The training time per group consisted of two hours per week over the semester.

With the help of a man volunteer from each subgroup, it was taught the localization of the anatomical orientation points to determine the site of surgical approach on the drainage thoracic (fifth intercostal space and the medium axillary line from the affected side) (Figure 1).

FIGURE 1 - Demonstration *in situ* of the anatomical orientation points to surgical approach on drainage thoracic.

Aiming an experience similar to the real approach of human thorax, it was constructed a surgical ex vivo pig model for the training of drainage thoracic using the following materials (Figure 2):

- A piece of swine ribs formed by two full ribs and one intercostal space with all the tissue layers preserved;
- Two plastic basins, a bigger one of 8 liters; and a smaller one of 4 liters. The smaller one had its bottom removed and a lateral opening was made to make room for the vertebral portion of the swine anatomical piece;
- One roll of transparent adhesive tape;
- One party balloon number 10;
- One PVC wrap film roll for kitchen;
- One package of gauze pads;
- One timber support of 5 cm x 30 cm;
- One basic kit for anatomy dissection;
- One chest drainage tube 36 F;
- One water seal drainage bottle;
- Two Mononylon 3/0 suture threads with cutting needle;
- One 20 ml syringe;
- Examination gloves;
- One fenestrated drape;
- Red ink.

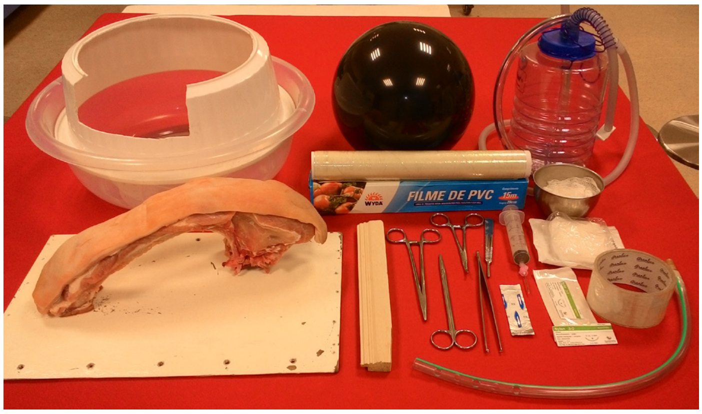

FIGURE 2 - Image of the materials for the production of the surgical ex vivo pig model.

For each training, 04 stations of dexterity were prepared and 03 students were distributed in each one; watched by a monitor, the students made the surgical ex vivo pig model according to the following steps:

1. One adhesive tape strip was placed with both adhering sides at the bottom of the bigger basin (Figure 3A).
2. The smaller basin was placed upside down, seated and fixed, with adhesive tape, inside the bigger basin until it was stable, safe and still (Figure 3B).
3. The balloon was filled until a height near to the removed bottom of the smaller basin, already placed upside down; it was sealed with an adhesive tape placed at the bottom of the bigger basin, simulating the lung (Figure 3C).
4. The structure was covered with three inner layers of PVC wrap film tensioned to simulate the parietal pleura (Figure 3D).
5. Red ink diluted in water was added into the basin through an air-gap without PVC wrap film, increasing the intracavitary pressure over the balloon, simulating the blood of a hemothorax.
6. The piece of swine rib cage was placed, supported by its vertebral portion, on the lateral opening of the smaller basin, and

the sternal portion was placed on the timber support, tangentially and above the removed bottom of the smaller basin (Figure 3E).

7. The structure was again covered with three outer layers of PVC wrap film so that the swine piece kept still, stable and in a central position, in order to keep up the contact between the inside of the ribs and the PVC wrap film that was covering the balloon (Figure 3F and G).

8. Finally, the surgical ex vivo pig model was covered with a fenestrated drape, just leaving exposed the surgical approach site from the piece of swine ribs (Figure 3H and I).

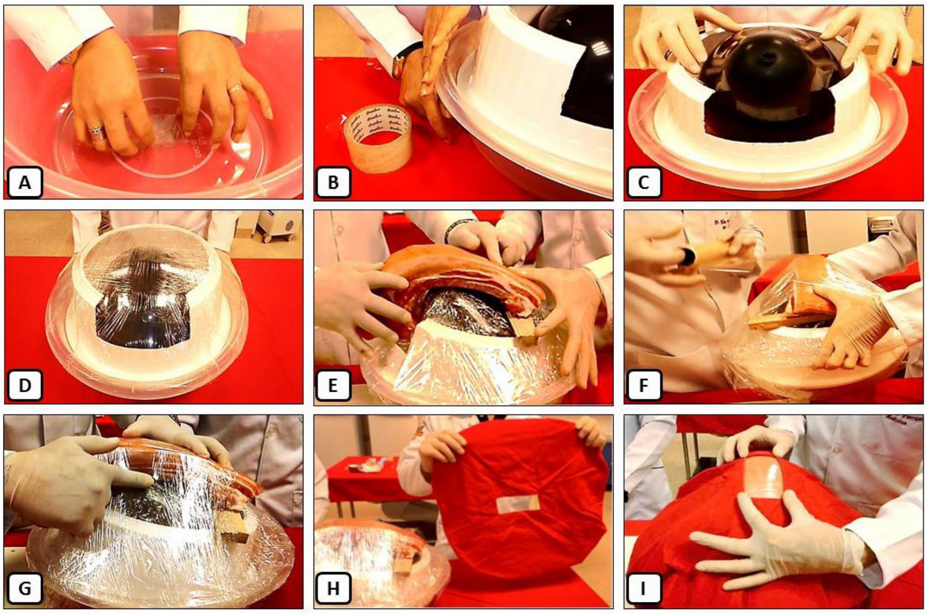

FIGURE 3 - Assembly of the surgical ex vivo pig model. **A**) Placement of the adhesive tape on the bottom of the bigger basin; **B**) Smaller basin placed upside down, seated and fixed, with adhesive tape; **C**) Air-filled balloon until it reached a height near the level of the removed bottom from the already upside down small basin, simulating the lung; **D**) Structure covered with three inner layers of PVC wrap film; **E**) Central positioning of the swine piece; **F**) Outer coverage of the structures with three other layers of PVC wrap film; **G**) Digital verification of the right contact between the inside of the ribs and the PVC wrap film; **H**) Fenestrated drape; **I**) Swine Surgical Model ex vivo ready for training.

Once the surgical ex vivo pig model was ready, the students executed the procedure trying to place the drainage thoracic tube into the simulated cavity "Without exploding the balloon". The procedure was repeated, whenever necessary, in case the balloon was damaged. The students repeated the step by step three times, as required, and after that were free to continue to repeat the procedure without the supervision of the monitor until the end of the section.

The drainage thoracic was executed according to the following steps[6]:

1. Simulation of the asepsis and antisepsis procedure on the site of surgical approach (Figure 4A);

2. Infiltration of local anesthetic with lidocaine 2% (Figure 4B);

3. Diaresis of the skin with a scalpel blade (Figure 4C);

4. Tissue divulsion by plans using Kelly forceps (Figure 4D);

5. Shaping an approach channel, using the finger to explore, until the localization of the intercostal space (Figure 4E);

6. Entrance to the cavity puncturing the parietal pleura (inner PVC layers) using Kelly forceps;

7. Placement of the drainage tube into the cavity (Figure 4F);

8. Fastening of the tube to the skin with Mononylon 3/0 (Figure 4G);

9. Digital verification of the intact filled balloon (Figure 4H);

10. Attachment of the tube with the water seal chest drain device (Figure 4I).

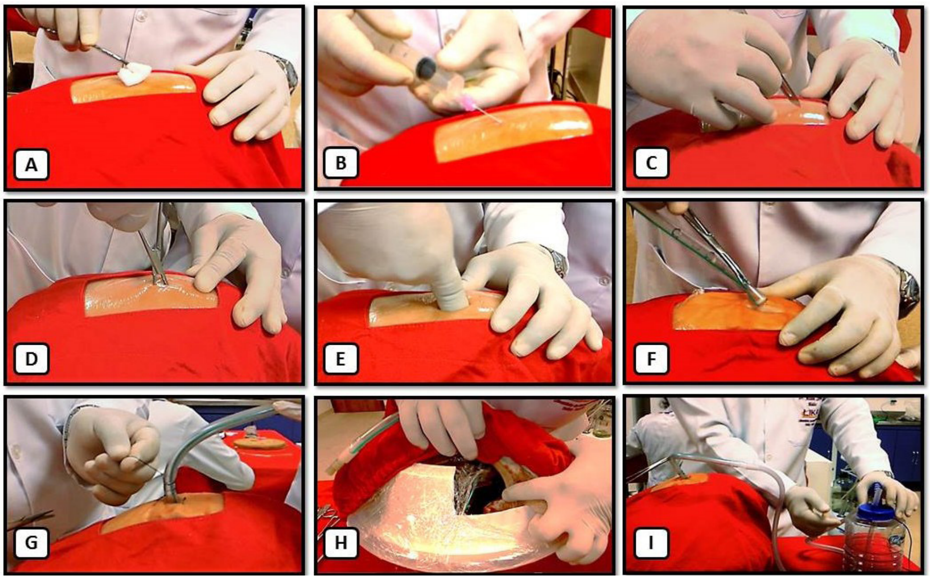

FIGURE 4 - Sequence of images of drainage thoracic execution on surgical ex vivo pig model: **A**) Asepsis e antisepsis of surgical approach site; **B**) Infiltration of local anesthetic with lidocaine 2%; **C**) Skin's diaresis; **D**) Tissue divulsion by plans; **E**) Use of the finger to explore; **F**) Placement of the drainage tube into the cavity; **G**) Fastening of the tube to the skin with Mononylon 3/0; **H**) Verification of the intact balloon; **I**) Attachment for the water seal device.

Phase 3: Evaluation

The data was collected by application of a Learning and Training Protocol of Emergency Procedures (PETPE) for drainage thoracic, an instrument created by the researcher, revised, corrected and approved by the logistical support team of the project (guiding psychologists) (Figure 5).

University federal of Pernambuco - Graduate Program in Surgery: Master Level
Project: Module Implementation Procedures Training
Emergencies Use Models for Development of Surgical skills in undergraduates
Medicine UFPE

PROTOCOL OF EMERGENCY PROCEDURES OF TEACHING-TRAINING CHEST DRAINAGE
(Please fill in all required fields)

Date: Sex: M F Age:
Period: Code:

1. about the trauma experience
1.1. Are you interest in trauma area? Yes No
1.2. Do you have experience in emergency procedures on patients? Yes No
1.3. Held some surgical training using of swine models? Yes No
1.4. Use these procedures regularly as a source of work, where and how long? Yes No
2. about the necessity of training:
2.1. You find it necessary training of students in:
- Basic Procedure resuscitation: Yes ( ) No ( )
- Chest Drainage: Yes ( ) No ( )
- Venous dissection: Yes ( ) No ( )
- Cricothyroidostomy: Yes ( ) No ( )
2.2. You think the anatomical swine model helps in the teaching procedure to medical students? Yes No
2.3. Find important the use of experimental models before performing invasive procedures on patients? Yes No
2.4. Find useful initial contact with emergency and resuscitation procedures through the use of models in medical graduation? Yes No
2.5. In which period would you suggest to be introduced this type of training?
1st 2nd 3rd 4th 5th 6th 7th 8th
2.6. Thinks necessary to develop other models of resuscitation procedures Yes No which?
____
3. About the quality of the anatomical swine model for chest drainage:
On a scale of 1 to 10 where 1 = worst, 10 = best
3.1. What note considers the theoretical explanation of chest trauma class, thoracic drainage?
____
3.2. What note considers the theoretical explanation of the experimental model used?
____
3.3. How do you think the anatomical used pig model has anatomical correlation with a human chest? __________
3.4. Do you think enough training time to chest drain? Yes No
3.5. The level of deepening class adequate? Yes No
3.6. You have any suggestions to enhance this model and improve the training? Yes No

FIGURE 5 – Learning and Training Protocol of Emergency Procedures (PETPE) for Drainage Thoracic.

From this instrument, a matrix of essentials competences was constructed, covering the learning needs and cognitive and psychomotor abilities development of the student, in accordance, as understood, with the National Curriculum Guidelines[7]. The protocol was applied in two moments: as a pre-test, before the beginning of the theory classes and training, and as a post-test, after the end of the groups training.

The level of assimilation, retention and theory use of both groups was evaluated by the professors of the chosen subjects by application of a both multiple choice and writing exam, regarding the standard score used of the medical course from UFPE which establishes a score from 0 to 10, according to the record of the student's correct answers, and establishes the score of 7 as the minimum score for approval (SATISFACTORY criteria for our research).

The estimation of surgical abilities developed by students was evaluated in a practice exam by the application of the Objective Structured Assessment of Technical Skills (OSATS) scale[8-10]. This exam evaluated six variables with individual values from 1 to 5 (total of 30 points), considering as "***SATISFACTORY***" every individual score above 16 points (Table 1).

TABLE 1 – Objective Structured Assessment of Technical Skills Scale (OSATS), used to determine student's competence development on the final exam after the training.

OBJECTIVE STRUCTURED ASSESSMENT OF TECHNICAL SKILLS (OSATS)
GLOBAL ASSESSMENT SCALE OPERATING PERFORMANCE

STUDENT'S NAME: **GROUP:** **CODE:** **PROCEDURE:**

Please, circle the number corresponding to the candidate's performance in each category, regardless of the training level

1. Respect to tissues:	1	2	3	4	5
	It often uses unnecessary force in handling the tissue or causes damage by inappropriate use of instruments		Carefully manipulates the tissues, but occasionally cause inadvertent damage		Consistently and properly handles the tissues causing minimal damage
2. Movement time:	1	2	3	4	5
	Many unnecessary movements		Efficient time / movement, but sometimes uses unnecessary movements		Clean and economic movements, with maximum efficiency
3. Knowledge and handling of the instrument:	1	2	3	4	5
	It shows a lack of knowledge in the use of instruments		Competently use the instruments but appears occasionally some degree of rigidity or inability		Shows obvious familiarity with the use and handling of instruments
4. Operating flow:	1	2	3	4	5
	Conducts frequent stops in the procedures and seems unsure of next move		Demonstrates some degree of forward planning with reasonable progress in the procedure		Shows obvious planning in the course of dealing with natural flow of movement for the next sequence of steps
5. Assistant Direction:	1	2	3	4	5
	The assistant is consistently misplaced and / or not properly guide the attendants		Guide properly assistants but exceeds the time		Guide and use strategically to the assistants to the best advantage at all times of the procedure
6. Specific knowledge of the procedure:	1	2	3	4	5
	Demonstrates knowledge deficit. It took many instructions at most steps		It knew all the important stages of the procedure		Demonstrated familiarity with all aspects of the procedure

Comments: **Tester Name:** **Date:**

The exam to evaluate practice abilities happened after all subgroup's training and had an identical methodology as those, but this time was applied by professors and monitors of the chosen subjects, they were capacitated to this purpose before the beginning of the project.

One hour before the abilities exam, the students were given a clinical case that required, among the handling of a polytrauma patient, the execution of drainage thoracic as a solution against a massive hemothorax condition.

On the evaluation station, the student had at disposal two (02) steady monitors as assistants and one (01) floating monitor completing a simulation of a trauma team which had to be driven during the test/simulation of the clinical case (Figure 6).

FIGURE 6 – Dexterity station. Three students performing the drainage thoracic procedure on a surgical ex vivo pig model.

The monitors were not allowed to speak during the simulation, except to direct the students and to give orders related to the progress of the exam.

The time spent by the students on the execution of the procedure was clocked and registered having as a reference value the average time spent during the training. Thus, each student had 5 minutes to execute the procedure and solve the clinical case received at the beginning of the exam.

The fact of exploding or not the balloon of the model wasn't determinant for the final score, instead, the priority of the evaluation was centered on the quality, speed and ability of the handlings, direction of the assistants and the capacity to resolve the case.

Statistical analysis

In order to assemble a table for the data, a spreadsheet was created in Microsoft Excel, which was exported to the software SPSS version 17, on which the analysis of the variables was made. The Chi-square test was applied on the prevalence found for the purpose of comparing the proportions and to obtain the homogeneity of the comparison of pre- and post-test results.

In the cases where the assumptions of the Chi-square test weren't satisfied, the Fisher's Exact Test was applied. The descriptive analysis of the knowledge scores was made by the statistics: mean and standard deviation. The normality of the score was evaluated by the Kolmogorov-Smirnov test. In the cases where the test didn't indicate normality, the Kruskal-Wallis test was applied to compare the distribution of group's A and B knowledge scores.

The meaningfulness level was fixed in p=0.05 for all the analyzed variables.

Results

The sample composition showed a female preponderance in both groups, but group B had a higher age range. The application of the PETPE for drainage thoracic on pre-test confirmed that students had no previous exposure to a constructive methodology similar to the proposed on the research.

The evaluation of student's perception about the theory explanation, acceptance of the surgical ex vivo pig model, and the anatomical correlation between the model and the human, revealed average score higher than seven (7), considering these as "SASTISFACTORIES" to the research.

The results of the both multiple choice and writing exam showed the value $p>0.05$ indicating that the average score does not differ significantly; nevertheless, there were differences between the absolute results. Group A obtained a better use and retention from the classes (mean = 9.5 ± 0.5 / 10) when compared with group B (mean = 8.8 ± 1.1 / 10).

The evaluation of abilities showed a significant difference ($p<0.05$) between the average scores of the groups, nevertheless, the scores obtained on individual evaluation of each variable of OSATS exceeded the reference parameter (2.6 points), considering these results "SATISFACTORIES" for the research.

Although the overall average of abilities evaluation ($p<0.05$) favors group "B", the individual results analyzes showed that group "A" reached higher average scores than group "B" in three out of six evaluated variables according to OSATS scale[8-10,] (variables 3, 5 and 6) (Table 2).

TABLE 2 – Comparative index of results between Groups A and B (theoretical and abilities exam).

Type evaluation	Results		
	Averages		Differences
Theoretical (Objective-discursive test)	Group A	Group B	p-value[1]
	9.5±0.5	8.8±1.1	0.006
Practice - Skills Test (OSATS)			
Averages Investigated			
1. Respect to tissues	3.5±0.6	3.9±0.9	0.798
2. Movement time	3.5±0.7	4.1±0.8	<0.001
3. Knowledge and handling of the instrument	4.3±0.7	3.8±0.8	<0.001
4. Operating flow	3.4±1.0	3.9±0.8	0.208
5. Assistant direction	3.4±0.7	3.0±1.2	<0.001
6. Specific knowledge of the procedure	4.7±0.6	4.3±0.8	<0.001
General	**22.8±1.8**	**23.0±2.8**	**<0.001**

[1] p-value of the test by Kruskal-Wallis (If p-value <0.05 averages differ significantly).

Discussion

Several pedagogical methods and strategies have been developed in order to cover the needs of surgical technique teaching during graduation[11-14].

In our project, psych pedagogic criteria with a constructive focus was introduced[15]. It allowed the design of a dynamic and developer methodology, facilitating the trust of the Professor-Monitor-Student trinomial during the process of knowledge construction and abilities development (learning and training process), providing an active paper to the student and converting him on the key element of its own medical shaping.

Compared to traditional methods[1], by the implementation of this pedagogical proposal on the project, it could be generated an enabling environment so that the student could express ideas and expose limitations with respect to its manual skills without fearing the mistake during the execution of drainage thoracic procedure. Therefore converting "the mistake" into the raw material for the knowledge and abilities construction, both theoretical and practical.

We also included a playful component brought from sports sciences because of evidence that this is a determining factor in the formation of high-performance athletes, we decided to adapt it to the theoretical dynamics as puzzle-like questions and to the trainings as little competences between subgroups recording the time that each working team used to perform the procedure successfully.

This factor had a higher positive impact on students from group "A" which demonstrated enthusiasm during training when compared to students from group "B", which showed to be passive and concerned, especially when the balloon from the model exploded during execution of the procedure.

Perhaps, this is explained due to the fact that students from group "B" faced their reality of surgical skills disability or lack, a worrying fact due to the proximity of medical internship and the possibility of executing this procedure on a real critical patient. On the other hand, students from group "A" showed no concerns on the technical faults committed during the procedure, aware of the time that they still have until they reach the internship, but also shown commitment and enthusiasm in every training.

Some research with a similar methodology highlight the need for close integration between theory and practice, however, the main difficulty for students training is in the obtainment of surgical material (cadavers), the fact that forces to reduce the practice for another theoretical class[16].

The surgical *ex vivo* pig model, introduced in this work, was included as a key tool from the constructive methodology designed, allowing the students to reproduce the palpation experience of tissues and the resistance of thoracic aponeurosis. This leaded to the development of sensitivity in handling, especially during the parietal pleura dieresis (simulated by PVC wrap film on the outer coverage of the model) at insertion of the drainage tube without exploding the balloon.

All the participants on the research qualified the palpation experience during insertion of the drainage tube in surgical ex vivo pig model as "SATISFACTORY" (average score above 7), similar to results of studies made with residents[17]. However with the fundamental difference that our students "never had a real experience of the procedure in a living patient", for what we believed that this tool could be included and applied with great results not only at medical residency but also during medical graduation regardless the students semester, only adjusting the teaching method and keeping the constructive methodology, as proposed.

Other studies that used swine pieces and from other biological sources[5,12], for surgical training during graduation, highlight the need for further research in order to evaluate the use of this type of instrument (models) associated with tangible results[17].

At the beginning, the clear and obvious differences of the level of theoretical knowledge highlighted between both groups, showed to be less expressed during training. However, students from Group "A" had no knowledge of basic surgical instruments handling, surgical times, nor had practiced a drainage thoracic with any method, showed erratic, inaccurate and unnecessary movements during the execution of the procedure, own attitude of who performs these handlings for the first time.

However, similar situation was observed among group "B" students, that even with the theoretical framework own by an eighth semester student, also highlighted the same difficulties as the items listed for group "A", showing a lack of basic surgical abilities and dexterity not compatible with the expected profile for this group, once those students are closed to the internship.

The constructive methodology applied on this research allowed the study of educational phenomena of knowledge genesis and acquisition and the simultaneous monitoring of the symmetric and synchronized development of early surgical competences on students from group "A", from its conception (theoretical) until its implementation (practical), and compare them with those observed on students from group "B".

This comparison showed that students from beginning levels at medical course (Group A) are able to acquire knowledge and develop surgical abilities close or similar to those seen on students from advanced levels (Group B), as shown by the results from the obtained average score. Thus, strengthening the need for a pedagogically structured methodology comprising a systematic training and an objective evaluation synchronized with the theoretical course contents.

The inclusion of the surgical ex vivo pig model as a base on surgical training of our methodology, allowed the repetition of the moves whenever necessary, correcting mistakes, eliminating erratic and unnecessary movements, high lightening the clinical surgical essential abilities development, improving the cognitive function and stimulating the sensorimotor perception; due, the procedure execution became clear, with harmonic, secure and synchronized movements on both groups as shown by the parameters registered by OSATS scale.

The results of theoretical evaluation allow to appreciate that the gap of knowledge that, at the beginning, marked a profound difference between the groups, was progressively filled by the constructive methodology applied, a fact expressed as correct answers of the same both multiple choice and writing test applied to both groups.

These results suggest the importance of including creative and innovative pedagogical strategies as the one proposed in this work, which is possible to be applied both to students from initial levels and from advanced levels from the medical course, demonstrating that positive and homogeneous results may be obtained, regardless of the academic level, gender, age and other variables.

Despite the existence of multiple types of lower costs simulators on the market, not all offer similar anatomical structures to the human thorax[18]. The researches that used swine ribs in their structures for the construction of their models suggest the viability of its use as a tool for the drainage thoracic training and, on the participants opinion, the use of this model allows a realistic during the surgical approach without ethical concerns during the training[17].

The swine rib cage used in the assembly of our surgical ex vivo pig model, more economical and easier to build when compared to other simulators[17-19], provides the layers, thickness and resistance of the tissues own by the thorax, and, along with other materials, simulates an hemothorax when constructed, allowing the student an authentic palpation perception and also the possibility to repeat the movements whenever necessary during the surgical approach, element that consists on the main advantage of our proposed model.

All the participants agreed that "the insertion of the drainage thoracic tube using the surgical ex vivo pig model was a realistic experience", coinciding with others similar studies[17]. Also, they judged themselves as trained and safe to perform an eventual drainage thoracic on an emergency patient, if necessary, but also being aware of the risks and complications that this implies.

Researches show a lack of confidence and security of recently graduated physicians during the execution of a drainage thoracic[19], limiting their response capacity with respect to the emergency care of polytrauma patients with thorax trauma, qualities only developed during the time, by daily professional experience.

The surgical *ex vivo* pig model used in this research was developed and tested by Spencer *et al.*[20] in UNIOESTE. From this reference, we managed to improve its structure, including it as the main element to test the constructive methodology proposed on this work.

In our case, we opted for constructivism as the key focus of the designed methodology, but it may be replaced by other flexible pedagogic approaches in accordance to the own needs of each institution of medical education and target population.

The lack of inclusion of medical residents and recently graduated physicians with and without experience in the procedure, in order to test the surgical ex vivo pig model and compare the palpation experience with the approach of a human thorax where limitation factors to the research. The teachers from the selected subjects did not test the model, such inclusion would probably provide a qualitatively higher validation than the one obtained.

Surgical approach of the swine skin, thick and resistant, represented a difficulty in dieresis and synthesis of tissues, this being a limitation found on the model.

The literature review did not report similar studies performed with medical graduation students applying pedagogical models for longer periods of time as presented in this work, therefore, we hadn't find parameters that evaluated this pedagogical proposal, opening the way for new studies with use of this type of methodology.

From the results of our research we can conclude that it is not necessary to wait until students have reached advanced semesters (6°,7° or 8°) to begin the development of their basic surgical abilities and dexterity; instead, those should be taught, stimulated, and developed on the begging levels of their formation, and be progressively enhanced during the semesters, under the assumption to count, at the end, with students ready for the medical internship, with clinical and basic surgical essential capacities already developed.

Further investigations regarding the development of embracing methodologies with holistic and inclusive character, that allow an integral development with both theory and practice of the trainee physician, and the inclusion of innovative teaching methods are still necessary.

Conclusion

The implementation of a constructive methodology grounded on the use of surgical *ex vivo* pig model for the learning and training process of drainage thoracic, we proved that students from initial semesters are able to acquire uniform and satisfactory knowledge and develop surgical skill similar to those demonstrated by students from advanced semesters of the medical course at Universidade Federal de Pernambuco, when compared.

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