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A New Three-Dimensional Paper Model to Teach Inguinal Anatomy

Un Nuevo Modelo Tridimensional de Papel para Enseñar Anatomía Inguinal

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SUMMARY: Learning anatomy is a challenge for health science students and the inguinal region is one of the most difficult parts. A good knowledge of anatomy is the basis for avoiding clinical errors. Practical teaching of anatomy has been based on cadaveric dissection, although in recent years alternative methods based on computer technology have appeared. A new practical method, carried out on paper by the students themselves, is presented and its usefulness is studied in comparison with cadaveric teaching. The learning obtained by students practicing with the new paper model is at least equivalent to that obtained with classical cadaver practice. The paper model is a good method to support the teaching of the anatomy of the inguinal region.

KEY WORDS: Inguinal; Anatomy; Teaching; Methods; New model.

INTRODUCTION

Human Anatomy is of great importance for the training of health professionals (Leonard, 1996; Mompeó & Pérez, 2003; Waithaka *et al*., 2023). It is a discipline perceived as difficult and demanding by students and teachers due to the large amount of data it contains and the complex transfer of this data to the reality of the human body (Bergman *et al*., 2011; Lazarus *et al*., 2012; Kumar *et al*., 2019). The inguinal region is a good example of this difficulty. It is a complex area in its composition and the arrangement of its elements is difficult to understand (Ansaloni *et al*., 2014). Deficient knowledge of its anatomy can lead to clinical errors (Jurjus *et al*., 2014) and its teaching is a challenge for teaching teams. Numerous studies have shown that upperclassmen and young professionals recognize the importance of anatomy practice and its integration with clinical knowledge (Sugand *et al*., 2010).

There is no solid evidence about the best method for teaching anatomy (Wilson *et al*., 2018). This discipline has been taught in the classical way by means of lectures and in the practical part by dissection of human cadavers, which has been considered the gold standard (McLachlan & Patten, 2006; Sañudo & Talarico, 2021). However, despite the years, there is not enough evidence to consider dissection as the best practical method. Dissection and manipulation of donors provide much needed manual skills for their professional future and performed in small groups is very useful as has been demonstrated in several studies. On the other hand, it requires a large number of donors and a demanding infrastructure for their preparation and preservation, and therefore a high cost.

As an alternative, various forms of hands-on teaching methods have emerged to replace or complement dissection. Among them we find mainly the use of 3-D physical models and computer-based methods (Tam *et al*., 2009). A large number of these are based on computer technology that requires specifically developed, sometimes expensive, software to finally display images on a 2-D screen. These have clear disadvantages such as dependence on technology and mainly that the student does not actively participate in their design and preparation. The validity of these alternative methods has been reviewed in the literature although they present methodological flaws. The anatomy of the inguinal region

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is one of the most complicated in the human body. It contains numerous structures in a small space. It is a transitional area between the abdomen and the lower limbs involving several body systems and has a three-dimensionality that is difficult to understand. In some studies, it is one of the subjects rated as demanding by students. This topic is included in the minimum that a future physician of the 21st century must master.

Target

The aim of the study is to demonstrate the usefulness of a new non-cadaveric practical teaching method for a better understanding of the anatomy of the inguinal canal. The research is carried out to demonstrate the non-inferiority of the new method compared to the classical donor dissection method. The teaching method we propose has the advantages of low cost, the possibility of repetition, total participation of the student and three-dimensionality for a correct understanding of the arrangement of the structures.

MATERIAL AND METHOD

Participants

This is a prospective experimental study, and the population are first-year students during the 2023-2024 academic years, in the Medicine, Physiotherapy and Physical Activity and Sport Sciences (PASS) degrees of the Public University of Navarra (Spain). All of them are first year anatomy students. The teaching content of the first semester is the same for students in all three grades. All students who attend the practical sessions and who voluntarily and anonymously answer the questionnaires are included. Excluded are those who repeat a year, as well as those who do not wish to participate in the study or do not attend the practical session.

A sample size calculation was performed using a calculator (Power Calculator for Continuous Outcome Non-Inferiority Trial) (Sealed Envelope Ltd., 2012), obtaining a minimum of 198 students for a non-inferiority study. The superiority study required greater recruitment.

The work has been approved by the Ethics, Animal Experimentation and Biosafety Committee of the Public University of Navarra with the number PI-003/23.

Methodology

The work follows the following outline:

1. Lecture on the inguinal region by the same teacher in all three grades. Students are introduced to the study and invited to participate. Emphasis is placed on the voluntary nature of answering the questionnaires, their anonymity and the lack of reward for doing so in the final mark for the subject.

2. A few days later, the practical session takes place. At the beginning of the session, the students are informed that they are randomly divided into two groups: cadaver group (GC) and paper model group (GP). The randomization is carried out in each practical session in a 1:1 computerized manner using the Excel tool.

An identification number is given to each of them, which they must keep until the end of the exercise. This number is given out at random and is not recorded by the teacher. The identification number is completely anonymous; it is not their university student number. The teachers in charge of the practical sessions are different in each session and are not directly involved in the study.

First, the students answer the initial questionnaire. This questionnaire is set up electronically in Google Forms. It is completely anonymous, and it is impossible to know the e-mail address from which it is answered. In the heading of the questionnaire, each student enters their study ID number, age, gender and university entrance score. There is a box where they indicate that they are answering the questionnaire on a completely voluntary basis. The questionnaire contains two Likert-type questions to assess the self-perception of knowledge of this subject. The first question asks about the level of knowledge each student thinks he/she has about groin anatomy. The second question asks about the difficulty of explaining the topic to a friend. After these two questions there are 10 multiple-choice questions on groin anatomy with four options and only one correct one. There is a final questionnaire that differs from the initial one only in one question about the satisfaction after the practice with a score from 0 not satisfied at all to 5 very satisfied (Appendix 1).

The paper model group (GP) remains in the classroom. The model is distributed by the teacher in the form of four sheets of paper (Lucas *et al*., 2023). It is based on a model created by Professor John Brady uploaded on the internet supported by a video tutorial on YouTube (Build Your Own Inguinal Canal - Paper Model) (Brady, 2017). Permission has been obtained from Professor Brady for the use and improvement of his model. Color and some structures have been added. In addition, a new video tutorial has been recorded (Appendix 2.)

The students construct the model by cutting out, folding and adhering with transparent tape. At the end of the practical, the students answer the final questionnaire.

Simultaneously, the students in the cadaver group (GC) go to the dissection room where a body is prepared with a dissection of the inguinal region and the main structures marked on it. The students are divided into groups of five and go to the donor where a teacher shows them the structures, invites them to palpate and check their arrangement.

At the end of the demonstration, the students answer the final questionnaire.

At no time do the two groups have contact with each other until the end of the practice.

The responses to the questionnaires are analyzed globally and anonymously. The following variables are studied:

- The characteristics of groups, dissection and paper, with respect to age, sex and university entrance mark. Age and university entrance mark are considered quantitative variables and sex qualitative.

- The degree of self-perception of the students' knowledge of the anatomy of the groin region before the practical session. For the first Likert question, 0 is no knowledge and 5 is perfect knowledge. For the second Likert question, 0 is could not explain the topic to a colleague and 5 would do it without problem. The variable is treated as quantitative, and the mean of the two groups is compared with Student's t-test.

- Theoretical knowledge of the anatomy of the groin region prior to the practical session from the ten technical questions in the initial questionnaire. The score is from 0, worst possible result to 10, best possible result. The means of the two study groups, paper and dissection, were compared by Student's t-test for quantitative variables. The Anova test was used to compare the means between the three types of students: medicine, physiotherapy and PASS.

- Theoretical knowledge of the anatomy of the inguinal region after the practical session extracted from the final questionnaire with a score from 0 to 10.

- A quantitative variable is created for each student, called learning, resulting from the difference between the score obtained in the knowledge test of the groin region after and before practice. The three types of students are compared with respect to this variable with Anova test.

- The variation in the degree of self-perception and confidence after practice with respect to the previous score. To do this, a difference is made for each student between their score before and after practice in each of the two Likert questions. These are treated as quantitative variables and the means are compared between the two groups under study.

- Degree of satisfaction with the knowledge acquired of the anatomy of the inguinal region after practice and comparison between the paper and cadaver groups. Numerical score from 0 not at all satisfied to 5 very satisfied.

A statistical analysis was performed to verify that the two randomized groups of the study, dissection and paper, were homogeneous with respect to age, university entrance mark and sex. In the case of quantitative variables, for the comparison of the means of two groups, it was previously necessary to know if the two groups followed a normal distribution. The Kolmorogov-Smirnov and Saphiro-Wilk tests were used. Subsequently, the Student's t-test was used. In the case of the qualitative variable sex, the Chi-square test was used. Qualitative variable was expressed as absolute values and percentages, and quantitative variables were expressed as mean and standard deviation (SD) for those that followed a normal distribution and median and interquartile range for those that did not. The Anova test was used to compare the means of three or more groups.

Any value of $p<0.05$ was considered statistically significant and the confidence interval was provided. In the study of the learning variable, the CI was 97.5 % mandatory in non-inferiority studies. If the distribution of the variable does not comply with normality, the non-parametric U-Mann Whitney test is applied with 95 % confidence interval.

The statistical analysis was carried out with IBM SPSS v. 25 (IBM SPSS Statistics for Windows, version 25.0. Armonk, NY: IBM Corp).

In the days following the practical session, the material related to the paper model is uploaded to the digital platform and a practical session is invited so that all students can complete their training with the paper construction or the donor demonstration.

RESULTS

A total of 204 students participated in the study after excluding those who were repeating a year (35 people). Medical students were distributed in three sessions, Physiotherapy students in two sessions and PASS students in a single session. All sessions took place in the last quarter of 2023. They were randomly distributed in each session into the cadaver group and paper group with a final distribution of 99 students in each group. Six students were excluded (2.9 %) from whom no computer response was obtained and for whom an identification number was provided (Table I). The final number of students in the study was 198.

Table I. Distribution of students by degree.

University Degree	N (%)	N (%)	N (%)
Medicine	47 (24.7)	46 (22.2)	93 (46.9)
Phisiotherapy	32 (16.6)	27 (13.1)	59 (29.7)
Pass	20 (10.6)	26 (12.6)	46 (23.2)

The mean of age was 18.21 years, 143 were female (72.2 %) and 55 male (27.8 %). The mean of university entrance mark was 12.71 out of 14. The Spanish university access system is a weighted average of high school evaluation (60 %) and entrance exam score (PAU) (40 %). There are regional variations because autonomous communities have the authority to implement cut-off scores from 0 to 14 (maximum). In our university, the cut-off scores for Health Sciences grades are normally from 11 to 14.

We compared the theoretical knowledge between the two randomized groups on the basis of the correct answers in the pre-practice questionnaire. In the cadaver group it was 3.31 out of 10 (SD 1.5) and in the paper group it was 3.82 (SD 2.08). No significant differences were found (Table II). The means of the three types of students were compared. Medical students obtained a mean of 3.38 (SD 1.23), Physiotherapy students 3.35 (SD 1.32) and PASS students 3.29 (SD 1.11). The one-way Anova test was not significant with F=0.31 and p=0.43.

Self-perceived knowledge of groin anatomy based on question 1 of the initial questionnaire was in the cadaver group 1.52 out of 5 (SD 0.62) and in the paper group it was 1.58 (SD 0.64) with no significant difference between the randomised groups with a $p > 0.05$ (Table III).

Regarding the second self-perception item of the initial questionnaire exploring the confidence to explain the subject to a partner, in the cadaver group it was 1.96 (SD 1.01) compared to 2.08 (SD 0.89) in the paper model group with a $p > 0.05$. (Table III).

To investigate the effect of sample size, a Cohen's test was performed, obtaining a d of 0.08 (p= 0.54) in the case of question 1 and 0.12 (p= 0.36) in the case of Likert question 2, which shows a slight effect of sample size.

Table IV. Comparison of range 0 to 10 of knowledge of inguinal anatomy pre and post practice.

	Pre-Practice Mean (SD)	Post-Practice Mean (SD)
Knowledge Cadaver group	3.33 (1.34)	4.81 (1.62)
Knowledge Paper group	3.35 (1.27)	6.98 (1.32)
Total	3.34 (1.31)	5.85 (1.84)

Table II. Comparison of the characteristics of the randomized groups. CI 95 % for the means difference.

Sex	Cadaver N (%)	Paper N (%)	Chi-square
Female	74 (74.7)	69 (69.7)	93 (46.9)
Male	25 (25.3)	30 (30.3)	59 (29.7)
	Mean (SD)	Mean (SD)	P [CI 95 %)]
Age	18.20 (0.47)	18.22 (0.6)	0.82 [0.27-0.11]
University Entrance Mark	12.48 (0.96)	12.56 (0.91)	0.81 [0.27-0.21]
Previous Knowledge	3.31 (1.5)	3.82 (2.08)	0.87 [0.39-0.33]

Table III. Comparison of the value of Likert questions pre-practice.

	Cadaver Mean (SD)	Paper Mean (SD)	P [IC]	Cohen's (p)
Likert Question 1	1.52 (0.62)	1.58 (0.64)	0.54 [-0.12-0.23]	0.08 (0.34)
Likert Question 2	1.96 (1.01)	2.08 (0.89)	0.36 [-0.14-0.39]	0.12 (0.36)

Question 1: How would you rate your knowledge of groin anatomy? 0 null, 5 perfect. Question 2: Would you be able to explain the topic to a friend? 0 could not, 5 no problem. t Student's CI 95% for the means difference. Cohen convention: >0.2 small, > 0.5 medium, > 0.8 large.

As already seen, the mean knowledge of the anatomy of the inguinal region prior to practice was 3.34 (SD 1.31) out of 10 and after practicing it was 5.85 (1.84) out of 10. The distribution in the two randomized groups is shown in (Table IV).

As for the main analysis of the study, we compared between the two groups, the means of the learning variable obtained in each student, by calculating the score before and after the practice, i.e. the gain in knowledge.

In the total study group, the mean of the learning was 2.51 and a SD of 1.77. In the cadaver group the mean knowledge gain was 1.41 (SD 1.18) and in the paper

group it was 3.61 (SD 1.61). Analyzing the comparison between the two groups, we obtain a p < 0.001 with a CI of 1.74 -2.63, which confirms the non-inferiority of learning in the paper group with respect to the cadaver group (Table V). This variable was analyezd with respect to the types of students and no statistically significant differences between groups were found. (Table VI).

The gain in confidence expressed numerically as the difference between before and after practice was higher in the paper group with values of 1.70 (SD 0.88) in question 1 and 1.71 (SD 0.88) in question 2 against the cadaver group which obtained 0.7 (SD 0.83) in question 1 and 0.73 (SD 0.85) in question 2. Significant differences with a p< 0.001 were found in question 1 and question 2 (Table VII).

Regarding the satisfaction obtained in the second questionnaire in a score ranging from 0 not at all satisfied with the practice to 5 very satisfied. This variable did not follow a normal distribution, and the medians of each group were compared with the U- Mann Whitney test. In the cadaver group the median was 2.26 (SD 1.12) compared to 3.88 (SD 0.87) in the paper group with a 95 % CI and a statistical significance of p < 0.001 (Table VIII).

Table V. Learning in the 2 randomized groups. t Student's t CI 97.5 %.

	Cadaver Mean	Paper Mean	P [IC]
Learning	1.41	3.61	P<0.001 (1.74-2.63)

Table VI. Comparison learning between degrees.

Degree	N	Learning Mean (SD)	ANOVA	p
Medicine	93	2.82 (1.52)		
Physiotherapy	59	2.52 (1.5)	07	0.65
PASS	46	2.79 (1.01)		

Table VII. Variation in confidence before and after practice. 95 % CI.

	Cadaver Mean (SD)	Paper Mean (SD)	P [CI]
Likert Variation 1	0.7 (0.83)	1.70 (0.88)	P<0.001 [0.54-1.05]
Likert Variation 2	0.73 (0.85)	1.71 (0.88)	P<0.001 [0.73-1.22]

Table VIII. Satisfaction of students after the practice (0 not at all satisfied to 5 very satisfied).

	Cadaver Mean (SD)	Paper Mean (SD)	
Satisfaction	2.26 (1.12)	3.88 (0.87)	P<0.001 [1.33-1.89]

DISCUSSION

The anatomy of the inguinal region is considered difficult to understand due to the arrangement of its main components in all three dimensions, it is crossed by a singular structure which is the inguinal canal with a specific arrangement, and it is a transition zone between the abdomen and the lower limbs.

Knowledge of this part of the abdominal anatomy is considered essential for training 21st century physicians, avoiding errors and obtaining good clinical outcomes in the future. In our study, the average theoretical knowledge after a lecture and personal study by the students was 3.34 points out of 10, far from a pass mark (5 points).

In the first steps of learning a subject, learners must acquire, organize and remember information (BLOOM acquisition). In this study, the aim was to investigate the students' confidence in the knowledge acquired by means of two Likert-type questions. This type of questionnaire allows us to investigate reactions, attitudes and behaviour. The first question proposes a self-assessment of knowledge of the subject on a scale from 0 (no knowledge) to 5 (perfect knowledge), obtaining an average of 1.55 out of 5.

The second question asked them to put themselves in a hypothetical situation of explaining the topic to a partner. This question was proposed because the explanation to another person requires a greater integration of knowledge, as shown in Bloom's taxonomy. The average score for this question was 2.02 out of 5.

This anatomical region needs, more than others, practical sessions to try to transfer theoretical knowledge to reality. Classically, demonstrations on donors have been used with mixed results. The dissection practised by the students provides them with the manual skills that are very necessary for their future professional careers and carried out in small groups is very useful, as has been demonstrated in several studies with external measurements or measurements of student opinion (Jeyakumar *et al*., 2020).

Among the major disadvantages of the use of donors is, firstly, the insufficient number for all students enrolled in Health Sciences degrees. The cadavers come from voluntary altruistic donation programs with a variable organization in the different Spanish universities. In addition, the preparation, preservation and use require a demanding infrastructure of dissection rooms and compliance with strict safety measures related

to possible risks of formaldehyde handling (Orsini *et al*., 2021; Neri *et al*., 2025).

Several modalities of practical teaching methods have emerged to replace and/or complement dissection. A large number of these are based on computer technology that requires specifically developed, sometimes expensive, software to finally display images on a 2-D screen.

There is scarce literature on the application of practical methods for teaching the inguinal region (Jacobs & Alvarado, 1981; Hindmarch *et al*., 2020). There are a large number of articles based on computer models based or not on radiological images[L1] where the three-dimensional element is obtained by manipulating the images displayed on the screen. Many of these methods require specific software packages often designed for each model. Computer simulation models are closely related to the clinical practice of inguinal hernia, which is the main pathology of this area.

Several of these papers do not investigate whether the proposed method has had an impact on students' learning by comparing students' notions before and after the application of the model or by comparing groups of students with and without the mode.

The teaching method studied in this work has the advantage of being low cost, the possibility of repetition, total student participation and three-dimensionality for a correct understanding of the layout of the structures. The material provided contains the basic structures of the inguinal region and its construction allows the arrangement of the different layers and the disposition of the inguinal canal through them. With the constructed model it is easy to answer the technical questions of the questionnaire as they help to clarify the order of the layers and the arrangement of the inguinal canal. This statement is supported by the results obtained from the questionnaires after the practical session where the students in the paper model group obtained a learning score of 3.61 points, which allows them to go from 3.35 / 10 before the practical session to 6.96 / 10 after the practical session. In the group that attended the cadaver demonstration, they went from 3.32 / 10 to 4.74 out of 10.

The work can also demonstrate a gain in self-confidence after the test, which was higher in the paper model group with statistically significant differences.

One of the limitations to this study is the lack of blinding by the teaching faculty. It may be argued that the teachers who attend the practical sessions, the main part of the study, are not involved in data analysis. The questionnaire is not validated to ensure the knowledge about inguinal anatomy, but we haven't found a validated one in the literature. Based on the methodological design, the comparison between the two groups required a large number of cases to demonstrate the superiority of the paper model with respect to dissection. It will be necessary to apply the study in successive courses incorporating more students. In addition, one of the future research objectives could be to compare whether the combination of the paper model and the dissection model is superior to the dissection model.

Another limitation could be that the study is performed on first-year students, and we do not know the knowledge of anatomy that graduates have. There is a need for further studies in more advanced courses.

Finally, teaching methods that involve active student participation, as is the case in this proposed model, classically obtain better learning results and are more satisfactory for students, as authors such as Burgoon *et al*. (2012) showed in their paper. In our study, the students who were in the group that built the model showed greater satisfaction than the group that attended the demonstration of the corpse.

CONCLUSIONS

The teaching method based on our paper model of the inguinal region has proven to be not inferior to the gold standard of donor dissection and allowed a correct acquisition of knowledge about this part of the human anatomy. The self-confidence of the students increased in this group and satisfaction was high.

The advantages of this model are its low cost, non-dependence on technology, student participation and the possibility of repeating it several times. In addition, it is three-dimensional and facilitates transfer to the reality of the human body.

New teaching methods for the teaching of human anatomy need to be further investigated by comparing them with each other in well-designed studies.

Probably the best teaching strategy should include several practical methods. Cadaveric dissection retains great advantages such as the development of manual skills on the human body; this gives students first-hand contact with bodies and develops in future professionals the ethical basis of the relationship between patient and health professional.

Our model is a good complementary method to dissection in the absence of further studies to confirm its good results.

Ethics Statement

The work has been approved by the Ethics, Animal Experimentation and Biosafety Committee of the Public University of Navarra with the number PI-003/23.

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BLÁZQUEZ LAUTRE, L.; YARNOZ IRAZÁBAL, C. & INSAUSTI SERRANO, A. M. Un nuevo modelo tridimensional de papel para enseñar anatomía inguinal. *Int. J. Morphol., 44(2)*:517-525, 2026.

RESUMEN: El aprendizaje de la anatomía representa un desafío para los estudiantes de ciencias de la salud, y la región inguinal es una de las más difíciles en este aprendizaje. Un buen conocimiento de la anatomía es fundamental para evitar errores clínicos. La enseñanza práctica de la anatomía se ha basado tradicionalmente en la disección de cadáveres, si bien en los últimos años han surgido métodos alternativos basados en la tecnología informática. En este estudio se presenta un nuevo método práctico, realizado en papel por los propios estudiantes, y se estudia su utilidad en comparación con la enseñanza cadavérica. El aprendizaje obtenido por los estudiantes que practican con el nuevo modelo de papel es, como mínimo, equivalente al obtenido en la práctica clásica con cadáveres. El modelo de papel constituye un buen método para apoyar la enseñanza de la anatomía de la región inguinal.

PALABRAS CLAVE: Inguinal; Anatomía; Enseñanza; Métodos; Nuevo modelo.

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Appendix 1

Inguinal Canal

* Indicates that the question is mandatory

I have been informed that participation in this project is completely voluntary, without acceptance implying any benefit or rejection implying any harm.

I accept voluntarily

ID NUMBER ……………

1. The score you would give to the knowledge you have of the structures of the inguinal region and their arrangement is: (0 no knowledge and 5 perfect knowledge) *

No knowledge

1
2
3
4
5

Perfect knowledge

2. If you had to explain the topic to a friend after having studied this course *
a) I couldn't because I have not understood it
b) I couldn't without studying it thoroughly
c) I would have difficulties
d) I would do it without problems

3. Which of these structures does not run through the inguinal canal? *
a) Spermatic vessels
b) Vas deferens
c) Epigastric vessels
d) Genitofemoral nerve

4. Which of these statements is not true? *
a) The superficial inguinal ring is medial to the epigastric vessels.
b) The deep inguinal ring is lateral to the epigastric vessels.
c) The internal inguinal ring is more superficial and anterior than the external inguinal ring
d) The inguinal canal runs between the deep or internal inguinal ring and the external or superficial inguinal ring.

5. Regarding the inguinal ligament, mark the incorrect *
a) It runs between Iliac spine anterosuperior to the pubis
b) It has extensions called the lacunar ligament and the Cooper ligament.
c) It runs above the superficial inguinal ring
d) It is the inferior border of the external oblique aponeurosis

6. Which of these structures is not part of the posterior wall of the inguinal canal? *
a) Fascia transversalis
b) Part of the joint tendon
c) Inguinal ligament
d) a and b are correct

7. Mark the layer of the abdominal wall that we do not find in the external genitalia of the male. *
a) Peritoneum
b) Transverse abdominis muscle
c) Internal oblique muscle
d) Scarpa fascia
ç8. Which of these compositions contains a structure that is not located in the inguinal region? *
a) Inguinal ligament, lacunar ligament and conjoint tendon

b) Fascia transversalis, inguinal ligament and inguinal cord
c) Internal oblique muscle, transverse abdominis muscle and linea alba
d) Cooper ligament, pubic spine and external oblique fascia

9. Which of the following statements is correct? *
a) Direct inguinal hernias emerge through Hasselbach's triangle, which is lateral to the inferior epigastric vessels.
b) Indirect inguinal hernias are called external obliques and exit medially to the inferior epigastric vessels
c) Femoral hernias emerge below the inguinal ligament and medially to the femoral vessels.
d) Direct inguinal hernia has an important congenital component due to the descent of the testis.

10. What is the arrangement of the layers of the anterolateral abdominal wall from superficial to deep? *
a) External oblique aponeurosis, internal oblique muscle, transverse muscle, transversalis fascia
b) External oblique aponeurosis, transverse m., internal oblique m., peritoneum
c) M. transversus, fascia transversalis and anterior rectus sheath
d) Anterior rectus sheath, pectineus m. and linea alba

11. Regarding the inguinal canal, WHAT IS NOT TRUE. *
a) Runs from deep inguinal ring to superficial inguinal ring
b) its floor is the inguinal ligament
c) It flows from a posterior plane to an anterior plane.
d) The deep or posterior plane is more medial than the superficial plane.

12. Which is correct concerning the inferior epigastric vessels? *
a) They are located between the deep inguinal ring and the pubis.
b) Hernias that protrude laterally to them are direct hernias.
c) They are not a boundary of the Hasellbach triangle.
d) All are correct.

13. How satisfied are you with what you have learned about this topic so far. (0 not at all satisfied, 5 very satisfied) *

Not at all satisfied
0
1
2
3
4
5
Very satisfied

Appendix 2

Video tutorial for building the model: http://upnatv.unavarra.es/pub/video-tutorial-de-modelo-en-papel-de-la-region-inguinal

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