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Critical view of the myopectineal orifice: a scoring system to objectively evaluate transabdominal preperitoneal inguinal hernia repair

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Abstract

Background More than 20 million inguinal hernia repair (IHR) procedures are performed worldwide every year. The critical view of the myopectineal orifice (CV of the MPO) is a stepwise guide to the achievement and standardization of minimally invasive IHR (MI IHR). We propose a scoring system as an objective method for fulfillment of the CV of the MPO.
Methods The scoring system was employed for evaluation of the transabdominal preperitoneal (TAPP) technique in 15 video-recorded procedures. Two variants of the score were used: the simple CV of the MPO score (s-CVMPO score) and the extended CV of the MPO score (e-CVMPO score). The inter-rater agreement and internal consistency for both scores and the correlation between the two scores were assessed.
Results Inter-rater agreement with respect to satisfactory/unsatisfactory achievement of the CV of the MPO was high for both the s-CVMPO and e-CVMPO scores ($\kappa = 1$, $p < 0.001$). The Finn coefficient for inter-rater agreement was 0.97 for the s-CVMPO score and 0.99 for the e-CVMPO score ($p < 0.001$ for both). Both the s-CVMPO and e-CVMPO scores showed internal consistency with Cronbach's α of 0.89 and 0.87, respectively. The correlation coefficient between the two scores for the average score of each procedure was $\rho = 0.96$ ($p < 0.001$).
Conclusion The CVMPO score is a reliable tool for expert evaluation of TAPP repair. Implementing the CVMPO score facilitates objective assessment of the safety and quality of the procedure.

Keywords Inguinal hernia repair · Critical view of the myopectineal orifice · Transabdominal preperitoneal · Minimally invasive surgery

More than 20 million inguinal hernia repair (IHR) procedures are performed worldwide every year. IHR is one of the most frequently performed procedures in general surgery. Most inguinal hernias are symptomatic, and the only available cure is surgery [1].

Among the surgical options for inguinal hernias, minimally invasive surgery (MIS) has proven substantial advantages such as faster postoperative recovery, less severe early postoperative pain, and less severe chronic pain [2, 3]. MIS includes both laparoscopic and robotic surgery [4, 5]. Some technical advantages of minimally invasive IHR (MI IHR) are better exposure to the surgical field and enhanced visualization. MI IHR also provides greater benefit for the management of femoral, obturator, and bilateral defects [1].

The concept of the critical view of safety was initially established for laparoscopic cholecystectomy to reduce the incidence of biliary duct injuries [6]. A similar concept,

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termed the critical view of the myopectineal orifice (CV of the MPO), was introduced in 2017 by Daes and Felix with a great contribution of Dr. Jacob, who provide one of the first images of the CV of the MPO [7]. The CV of the MPO is a stepwise guide to the achievement and standardization of MI IHR. In 2020, Claus et al. [8]. added anatomical aspects (triangles) to the previously established steps. Many surgeons do not follow a standardized approach to MI IHR, as we have witnessed in multiple videos produced by various surgical groups. This may be related to the technical difficulty of MI IHR, which requires a longer learning curve than the open technique. The learning curve for the transabdominal preperitoneal (TAPP) approach is variable and not well established, and the need to perform around 50 to 75 procedures is suggested in several different papers [9–11].

Validated tools are available for evaluation of surgeons' skills in MI IHR, but these tools do not consider many of the aspects already described in the CV of the MPO [12, 13]. The score proposed in the present report includes the most relevant criteria necessary to develop a safe technique with which to prevent surgical and postoperative complications (e.g., chronic pain, hematoma, seroma) and recurrence during MI IHR. Regardless of the MI IHR technique used (TAPP repair, robotic-assisted TAPP repair, totally extraperitoneal repair, extended totally extraperitoneal repair, or robotic extended totally extraperitoneal repair), the score is applicable. We propose this score as an objective method for fulfillment of the CV of the MPO. The present study was performed to evaluate the reliability of the score in TAPP IHR. We modified the scoring system in the present study to include steps inherent to the TAPP technique. See Tables 1 and 2.

Peritoneal flap opening: The peritoneal flap in TAPP IHR should be started with an incision at least 4 cm above the inguinal ring, extending from the anterior superior iliac spine (ASIS) to the medial umbilical fold [8]. This allows placement of a mesh of at least 15×10 cm to cover the direct, indirect, and femoral areas with an overlap of 3 to 4 cm, facilitate easier closure of the peritoneal flap, and decrease the risk of mesh exposure.

1. The pubic tubercle is identified and dissected across the midline and Cooper's ligament (CL). For large, direct hernias (> 3 cm, M3 of the European Hernia Society classification) [1], the dissection is extended to the contralateral CL.

2. A direct hernia is ruled out. Unusual fat is removed from Hesselbach's triangle.

3. At least 2 cm of tissue is dissected between CL and the bladder to facilitate flat placement of the medial and inferior edges of the mesh toward the space of Retzius, thereby avoiding mesh displacement caused by bladder distention.

4. Dissection is performed between CL and the iliac vein to identify the femoral orifice and rule out a femoral hernia. *Obturator hernia*: The obturator foramen is located under CL and inferomedial to the femoral orifice [14]. Although an obturator hernia is unusual, extended dissection to the obturator orifice (fat plug) ensures a wide inferomedial dissection. Compared with the anterior approach, the posterior approach offers greater visualization and easier handling over the obturator foramen and structures. A large unresected lipoma within the obturator canal resembles a cord lipoma and may cause discomfort and chronic pain [1, 15].

5. The indirect sac and peritoneum are sufficiently dissected to parietalize the cord's elements. This step is often not completed, especially in a small surgical field. To ensure compliance with this requirement, dissection should continue until the cord's elements lie flat. The psoas muscle and iliac vessels are then visualized, the sac and peritoneum are pulled upward without triggering movement of the cord's elements, and dissection is performed between the cord's elements to avoid missing a tail of the sac.

6. The surgeon next identifies and reduces any cord lipomas, which may appear small and unimportant until reduced. Usually lateral to the cord's elements, they should not be confused with lymph nodes (which are generally spared). Most lipomas do not require removal, but they should be placed above the mesh to help prevent the mesh from rolling upward.

7. The peritoneum is dissected lateral to the cord's elements laterally beyond the ASIS, sweeping it back inferiorly well behind the mesh's inferior border.

8. The dissection is continued and mesh coverage is provided. The surgeon ensures that the mesh and mechanical fixation are placed well above an imaginary inter-ASIS line and any defects, thereby avoiding recurrence and nerve injury, especially to the ilioinguinal nerve.

9. The mesh is placed only when items 1 to 8 are completed and hemostasis has been verified. The mesh size should be at least 15×10 cm, although a larger piece of mesh is sometimes required to cover the MPO. Preferably, mesh that adapts to the contour of the space and the cord's elements should be chosen. It should not have undue memory and it should be placed without creases or folds. Splitting the mesh should be avoided. The surgeon should also ensure that the lateroinferior corner of the mesh lies deep against the wall and does not roll up during space deflation.

Deflation: After adequate closure of the peritoneal flap, ideally without any permanent fixation, controlled and supervised deflation ensures that there is no mesh folding (i.e., "clamshell" appearance) or exposure. This can be accomplished with a peripheral venous catheter through the skin, ureteral catheter, or handpiece with aspiration through the gaps between the suture lines of the flap. When the flap is not closed, the deflation must be rigorously supervised and a second visualization with minimal pneumoperitoneal pressure must be performed.

Table 1 Simple critical view of the myopectineal orifice score

s-CVMPO score

	Criteria	1 point	0 points	Score
Dissection	*TAPP: Peritoneal flap opening*	Flap opening $\geq$ 4 cm above the DIR	Flap opening < 4 cm or visually close to the DIR	
	Visceral preperitoneal dissection in Zones 1 and 3	Extraperitoneal fascia (with the usual fat component) covering the nerves; the nerves are not exposed	Exposed nerves; extraperitoneal fascia not covering the nerves	
	Parietal preperitoneal dissection in Zone 2	Rectus muscle shape clearly visible + pubic tubercle uncovered + inner medial portion of the flap covered by extraperitoneal fat	Rectus muscle shape not visible, or pubic tubercle covered, or inner medial portion of the flap not covered by extraperitoneal fat	
	Identification of CL	Pearl appearance of the uncovered CL, clearly visible	CL covered by fat, not clearly visible	
	Medial dissection	Dissected > 2 cm between CL and bladder. Large direct hernia: dissection including contralateral CL	Dissected < 2 cm between CL and bladder. Large direct hernia: no contralateral CL dissected	
	Lateral dissection	Complete dissection beyond the ASIS and to the inferolateral corner until lateral border of the iliopsoas muscle is observed	Incomplete dissection to the ASIS or to the inferolateral corner; lateral border of the iliopsoas muscle is not observed	
Rule out hernia	*Direct hernia*	Direct hernia ruled out. Unusual fat in Hesselbach's triangle removed	Direct hernia not ruled out	
	Femoral hernia	Dissection between CL and external iliac vein	Femoral hernia not ruled out	
	Indirect hernia	Parietalization of the elements of the inguinal canal	Indirect hernia not ruled out	
	Cord lipoma	Iliopubic tract identified and the DIR explored	Cord lipoma not ruled out	
	Obturator hernia	Exploration under CL, securing the view of the obturator orifice	Obturator hernia not ruled out	
Mesh placement	*Securing parietalization of the cord's elements*	Medial: the vas deferens (or round ligament of the uterus) crosses the external iliac vein Lateral: the iliopsoas muscle is visible	Just one (or no) parameters, medial or lateral, accomplished	
	Pulled up proof	Flap pulled up without triggering any traction of the cord's elements	Flap pulled up, triggering traction of the cord´s elements (or not realized)	
	Final review (checklist)	Check the previous criteria to secure adequate dissection, and all defects are ruled out	Checking not realized. Adequate dissection is not secured and not all defects are ruled out	
	Mesh size	Mesh size at least 15 × 10 cm	Mesh size less than 15 × 10 cm	
	Adequate mesh overlap	-Medial: Pubic symphysis. Large direct hernia: 1–2 cm mesh crosses over contralateral CL -Lateral: ASIS (superior) and iliopsoas muscle (inferior) -Inferomedial: 2 cm below pubis -Superior: 3 cm above DIR	Not all references reached	
	Mesh fixation	$\leq$ 3 fixation spots	$\geq$ 4 fixation spots	
	Deflation	Adequate mesh placement without mobilization or folds after flap closure + controlled deflation	No evidence of the adequate mesh placement	

Table 1 (continued)

s-CVMPO score

	Criteria	1 point	0 points	Score
Penalization	**Criteria**	**0 points**	**-1 points**	**Score**
	Vascular	No vascular injury. Preservation of the inferior epigastric, femoral, and gonadal vessels and the corona mortis	Injury to the inferior epigastric, femoral, or gonadal vessels or the corona mortis	
	Vas deferens	Vas deferens safely manipulated. Round ligament transection: at least 1 cm proximal to DIR	Vas deferens aggressively manipulated. Round ligament transected: < 1 cm proximal to DIR	
	Nerve compromise	No apparent nerve compromise	Some of the steps may have compromised nerves (e.g., Zone 1 dissection, permanent tacks, fixation below iliopubic tract)	
	TAPP: Peritoneal flap closure	Closure of peritoneal flap without tacks. No unclosed holes	Closure of peritoneal flap with tacks. Presence of unclosed holes	
Total				

s-CVMPO score: simple critical view of the myopectineal orifice score

TAPP: transabdominal preperitoneal, *ASIS*: anterior superior iliac spine, *CL*: Cooper's ligament, *DIR*: deep inguinal ring

Peritoneal flap closure: Closure of the flap excludes the mesh from the contents of the peritoneal cavity, and it is necessary to close the gaps on the flap and secure no mesh exposure. Closure of the flap with tackers is associated with a greater risk of nerve injury [8, 16].

Methods

In this cross-sectional comparative study, our proposed score was employed for evaluation of TAPP IHR in video-recorded procedures. The videos were found using the search term "TAPP inguinal hernia repair" on multiple virtual platforms (YouTube®, WebSurg®, GIBLIB®, JOMI®, Hernia U®, and Incision Academy®) from 1 to 15 November 2020. The three most frequently viewed videos on YouTube® and WebSurg® and all the videos on the other platforms were obtained; in total, 15 procedures were evaluated. All the videos depicted the laparoscopic or robotic-assisted TAPP technique. The exclusion criteria were surgeries performed in nonhuman patients, videos not related to the surgical procedure, animated schematic videos, and finished/edited videos without complete dissection, mesh fixation, or flap closure. The type of sampling was non-probabilistic.

Four general surgeons (all experts in abdominal wall hernia repair who had performed more than 30 laparoscopic IHRs per year) and a fourth-year general surgery resident were selected as evaluators. Every participant was instructed by videoconference and direct training about the method of rating the videos. Prior to the video evaluation, the evaluators were encouraged to give their opinion and criticism about the scoring system. Each evaluator was asked at the beginning of the evaluation to decide whether the video satisfactorily met the CV of the MPO.

For optimal evaluation, we developed two variants of the score: simple and extended. Both scores comprised the same number of criteria within three sections of favorable criteria (Dissection, Rule out hernia, and Mesh placement) and one section of an unfavorable criterion (Penalization).

In the simple score (s-CVMPO score), each criterion was rated in a binary manner. A favorable criterion was assigned 1 point when it was fulfilled and 0 points when it was not, and an unfavorable criterion was assigned − 1 point when it was committed and 0 points when it was not. The maximum score was 17 points and the minimum was − 4. The minimum score considered satisfactory achievement of the CV of the MPO was 12 points.

In the extended score (e-CVMPO score), favorable criteria were rated from 0 to 2 points; 2 points were given when the criterion was fully fulfilled, 1 point when it was partially fulfilled, and 0 when it was not fulfilled. Not all criteria had the possibility of being partially fulfilled, including unfavorable criteria that were assigned − 2 points when

Table 2 Extended critical view of the myopectineal orifice score

e-CVMPO score

	Criteria	2 points	1 point	0 points	Score
Dissection	*TAPP: Peritoneal flap opening*	Flap opening ≥ 4 cm above the DIR		Flap opening < 4 cm or visually close to the DIR	
	Visceral preperitoneal dissection in Zones 1 and 3	Extraperitoneal fascia (with the usual fat component) covering the nerves; the nerves are not exposed	Fat component of extraperitoneal fascia partially dissected, but the nerves are not exposed	Exposed nerves; extraperitoneal fascia is not covering the nerves	
	Parietal preperitoneal dissection in Zone 2	Rectus muscle shape clearly visible + pubic tubercle uncovered + inner medial portion of the flap covered by extraperitoneal fat	Preperitoneal fat partially dissected: rectus muscle shape not clearly visible, or pubic tubercle partially covered with fat, or inner medial portion of the flap poorly covered by extraperitoneal fat	Rectus muscle shape not visible, or the pubic tubercle covered by fat, or inner medial portion of the flap not covered by extraperitoneal fat	
	Identification of CL	Pearl appearance of the uncovered CL, clearly visible	CL identified but covered by fat; not clearly visible	CL covered by fat, not visible	
	Medial dissection	Dissected > 2 cm between CL and bladder. Large direct hernia: dissection including contralateral CL	Dissected < 2 cm between CL and bladder. Large direct hernia: no contralateral CL dissected	No dissection between CL and bladder	
	Lateral dissection	Complete dissection beyond the ASIS and to the inferolateral corner until the lateral border of the iliopsoas muscle is observed	Incomplete dissection in direction toward the ASIS and inferolateral corner, somewhat less than the whole iliopsoas muscle	Too poor lateral dissection, ASIS or iliopsoas muscle not identified	
Rule out hernia	Direct hernia	Direct hernia ruled out. Unusual fat in Hesselbach's triangle removed		Direct hernia not ruled out	
	Femoral hernia	Dissection between CL and external iliac vein		Femoral hernia not ruled out	
	Indirect hernia	Parietalization of the elements of the inguinal canal		Indirect hernia not ruled out	
	Cord lipoma	Iliopubic tract identified and the DIR explored		Cord lipoma not ruled out	
	Obturator hernia	Exploration under CL, securing the view of the obturator orifice		Obturator hernia not ruled out	

Table 2 (continued)

e-CVMPO score

	Criteria	2 points	1 point	0 points	Score
Mesh placement	Securing parietalization of the cord's elements *Pulled up proof*	Medial: the vas deferens (or round ligament of the uterus) crosses the external iliac vein Lateral: the iliopsoas muscle is visible Flap pulled up without triggering any traction of the structures	Only one parameter, medial or lateral, accomplished Flap pulled up, triggering slight traction of the structures	Neither of the two parameters are accomplished Flap pulled up, triggering notable traction of the structures	
	Final review (checklist)	Check the previous criteria to secure adequate dissection, and all defects are ruled out	Check the previous criteria to secure adequate dissection, but not all defects are ruled out	Checking not realized. Adequate dissection is not secured and not all defects are ruled out	
	Mesh size	Mesh size is at least 15 × 10 cm		Mesh size is less than 15 × 10 cm	
	Adequate mesh overlap	-Medial: Pubic symphysis. Large direct hernia: 1–2 cm mesh crosses over contralateral CL -Lateral: ASIS (superior) and iliopsoas muscle (inferior) -Inferomedial: 2 cm below pubis -Superior: 3 cm above DIR	At least the references in relationship with the concerned hernia defect(s) are reached: -Medial for direct hernia -Lateral for indirect hernia -Inferomedial for femoral and obturator hernia	No references reached	
	Mesh fixation	$\leq$ 3 fixation spots	4 or 5 fixation spots	$\geq$ 6 fixation spots	
	Deflation	Adequate mesh placement without mobilization or folds after flap closure + deflation	The mesh seems correctly placed after flap closure. Deflation not realized	Visible folds or exposure of the mesh after flap closure. Deflation not realized	
Penalization	**Criteria**	**0 points**	**−1 point**	**−2 points**	**Score**
	Vascular	No vascular injury. Preservation of the inferior epigastric, femoral, and gonadal vessels and the corona mortis		Vascular injury. Injury to the inferior epigastric, femoral, or gonadal vessels or the corona mortis	
	Vas deferens	Vas deferens safely manipulated. Round ligament transected at least 1 cm proximal to DIR		Vas deferens aggressively manipulated. Round ligament transected < 1 cm proximal to DIR	
	Nerve compromise	No apparent nerve compromise		Some of the steps may have compromised nerves (e.g., Zone 1 dissection, permanent tacks, fixation below iliopubic tract)	
	TAPP: Peritoneal flap closure	Closure of peritoneal flap without tacks. No unclosed holes		Closure of peritoneal flap with tacks. Presence of unclosed holes	
Total					

e-CVMPO score: extended critical view of the myopectineal orifice score

TAPP: transabdominal preperitoneal, *ASIS*: anterior superior iliac spine, *CL*: Cooper's ligament, *DIR*: deep inguinal ring committed and 0 points when not. The maximum score was 34 points and the minimum was − 8. The minimum score considered satisfactory achievement of the CV of the MPO was 26 points.

In both cases, the CVMPO score was considered a numerical variable, and the quality (satisfactory or unsatisfactory) was considered a categorical variable.

Regarding ethical considerations, all the videos were evaluated, accessing the platforms according to each platform's specific requirements. There was no need for institutional review board approval or written consent. No patients or personal data were used. The local hospital research and ethics committee exempted the study from the Research Involving Human Subjects Act because no interventions were performed. No formal ethics approval was required for this study.

Data analysis

The database was recorded as a spreadsheet in Microsoft Excel 365® (Microsoft Corp., Redmond, WA, USA) and used for the descriptive analysis. The statistical inferential analysis was performed using RStudio® (R Core Team v.1.2.5033; R Foundation for Statistical Computing, Vienna, Austria) and SPSS® Statistics for Windows Version 23.0 (IBM Corp., Armonk, NY, USA). RStudio® (R Core Team v.1.2.5033) was also used for drawing graphics.

The inter-rater agreement for satisfactory/unsatisfactory achievement of the CV of the MPO was calculated with Fleiss' kappa, and the Finn coefficient for a two-way model was used for the rated score. Concordance was assessed as follows: no agreement (0.00–0.20), minimal agreement (0.21–0.39), weak agreement (0.40–0.59), moderate agreement (0.60–0.79), strong agreement (0.80–0.90), and almost perfect agreement (> 0.90).

To measure reliability, we performed an internal consistency assessment with Cronbach's α for both the s-CVMPO and e-CVMPO scores. The correlation between the two scores (s-CVMPO and e-CVMPO scores) was evaluated using Spearman's rank correlation for the average score of each procedure. A p value of < 0.05 was considered statistically significant.

Results

All the evaluators agreed to participate in the study. They expressed agreement with the rating criteria, and they found both scores pleasant to use. The mean time required to complete the scoring form was 36 ± 4 s for the s-CVMPO score and 57 ± 6 s for the e-CVMPO score. The time used to watch the videos was not included. Fifteen procedures were evaluated. According to the initial judgment, before applying the scores, 12 procedures were qualified by unanimous decision: 7 as satisfactory and 5 as unsatisfactory. For three videos, there was disagreement between the evaluators: three evaluators judged them as satisfactory and two as unsatisfactory.

Both scores (s-CVMPO and e-CVMPO scores) demonstrated consistent results; seven procedures were rated by consensus as satisfactory and eight as unsatisfactory. Notably, the three videos that produced disagreement were rated as unsatisfactory by the five evaluators employing both scores. In the statistical inferential analysis, the inter-rater agreement judging satisfactory/unsatisfactory achievement of the CV of the MPO showed $\kappa = 1$ and $p < 0.001$ for both the s-CVMPO and e-CVMPO scores. The inter-rater agreement showed a Finn coefficient of 0.97 ($p < 0.001$) for the s-CVMPO score and 0.99 ($p < 0.001$) for the e-CVMPO score; i.e., inter-rater agreement was almost perfect for both scores.

Both the s-CVMPO and e-CVMPO scores showed internal consistency with Cronbach's α of 0.89 and 0.87, respectively. The correlation coefficient between the two scores for the average score of each procedure was $\rho = 0.96$ ($p < 0.001$). See Fig. 1.

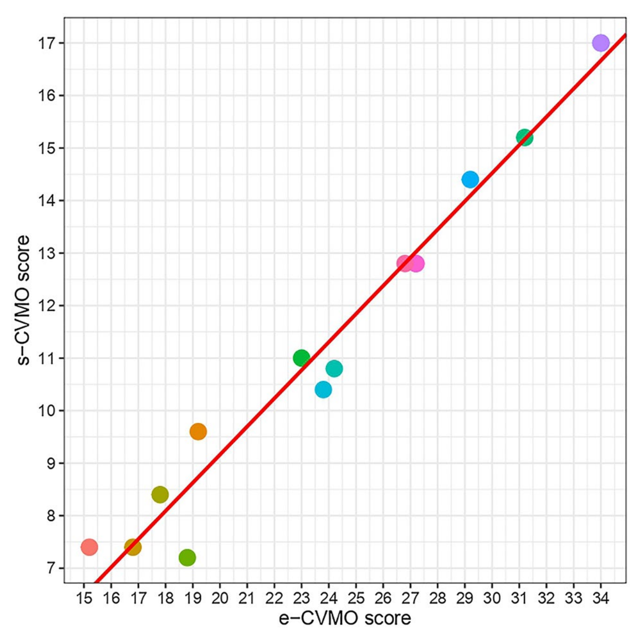

Fig. 1 Correlation between average s-CVMPO and e-CVMPO scores of the procedures. Spearman's rank correlation: $\rho = 0.96$, $p < 0.001$. Red line: least squares line of best fit. s-CVMPO score: simple critical view of the myopectineal orifice score, e-CVMPO score: extended critical view of the myopectineal orifice score

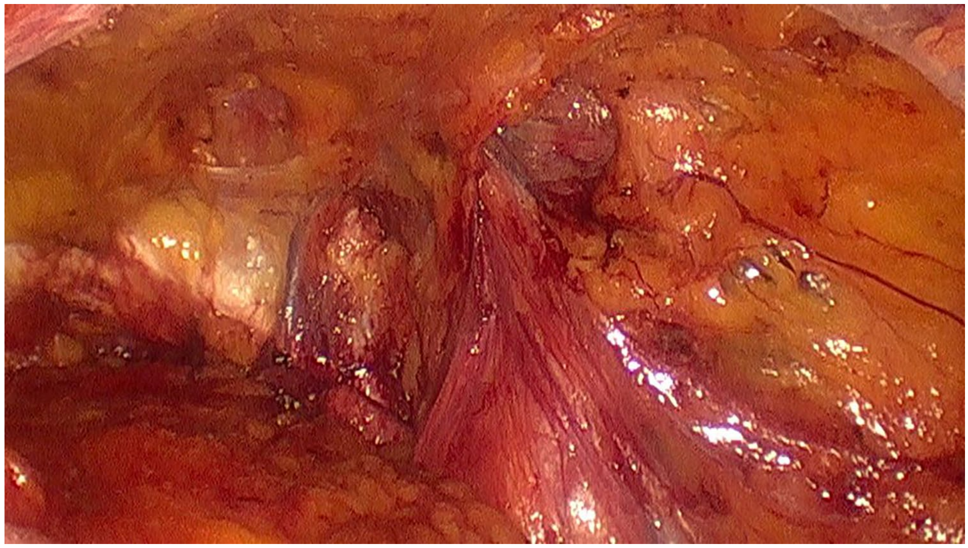

Fig. 2 Panoramic photograph of satisfactory critical view of the myopectineal orifice. Adequate dissection margins are observed. Unusual fat tissue is absent from direct, indirect, and femoral hernia sites. The iliopubic tract crossing the inferior edge of the deep inguinal ring is shown. The spermatic cord is seen crossing the external iliac vein, and the iliopsoas muscle is visible

Discussion

The CV of the MPO effectively standardizes MI IHR and facilitates teaching and evaluation of the technique while reducing the risks of complications and recurrence [7]. Similar to use of the Sandford–Strasberg critical view of safety score [17], the herein-proposed score is intended to improve the objectivity of the evaluation and application of the CV of the MPO. Video recording of IHR is the most common resource for storage, education, and feedback. The characteristics and conditions of video equipment such as a 30- or 45-degree laparoscope, high-definition camera and video, optimal contrast color, and light clarity are of utmost importance for safe performance of the procedure.

All the evaluators in the present study expressed complete acceptability of the structure, composition, and precision of the two variants of the CVMPO score. The inter-rater agreement obtained in the evaluation of both the s-CVMPO and e-CVMPO scores was almost perfect, and both scores showed very good internal consistency. Additionally, the correlation between the two scores was excellent. Our results show that both scores are appropriate for evaluating TAPP IHR. Nevertheless, because calculation of the s-CVMPO score is faster, we consider it more convenient for rating of recorded videos, whereas the e-CVMPO score is more suitable for structured teaching, skills laboratories, and transoperative use.

When using the CVMPO score during live procedures, we advise recording the degree of satisfaction with achieving the CV of the MPO and the obtained score in the operative notes; two still photographs should be attached to the operative notes, and video storage should be included when it is available. The still photographs should include a panoramic view showing the boundaries of the dissection and the hernia sites and another panoramic view showing the final mesh position and the fixation spots (if fixed). See Figs. 2 and 3. Although photographs are easy to store, we considered videos to be the most complete way to store information regarding the CV of the MPO because they are dynamic and sequential.

As an educational tool, the CVMPO score aims to enhance the educational process by shortening the learning curve of MIS inguinal hernia procedures. The evaluation tools for procedural assessment are useful for the identification of specific sets of deficient skills and allow for the provision of point-to-point feedback [18]. Early incorporation of the CV of the MPO into the training program of surgical residents would extend its implementation in future practice.

We suggest use of the herein-described score for TAPP IHR and other MIS techniques with some modifications. Criteria concerning flap manipulation (opening and closing of peritoneal flap) must be excluded from extraperitoneal techniques, and the maximum score and satisfaction aspect of both scores should thus be modified.

Although it was not the purpose of this work, the CVMO score accomplish certain and crucial parameters of validation. The CVMO was founded on the original description of the critical view of the myopectineal orifice and the most actual sustaining evidence, complying with the content validity parameter. The face validity was met according to the comments of the evaluators, who expressed agreement with the rating criteria and found the score suitable for the evaluation of the CV of the MPO. Both the s-CVMPO and e-CVMPO scores showed a very good interitem reliability (Cronbach's α of 0.89 and 0.87, for the s-CVMPO and e-CVMPO, respectively) and almost perfect inter-rater reliability. Pursuing this validation process, the score should be evaluated in prospective with larger size sample studies assessing its impact on recurrence and complications.

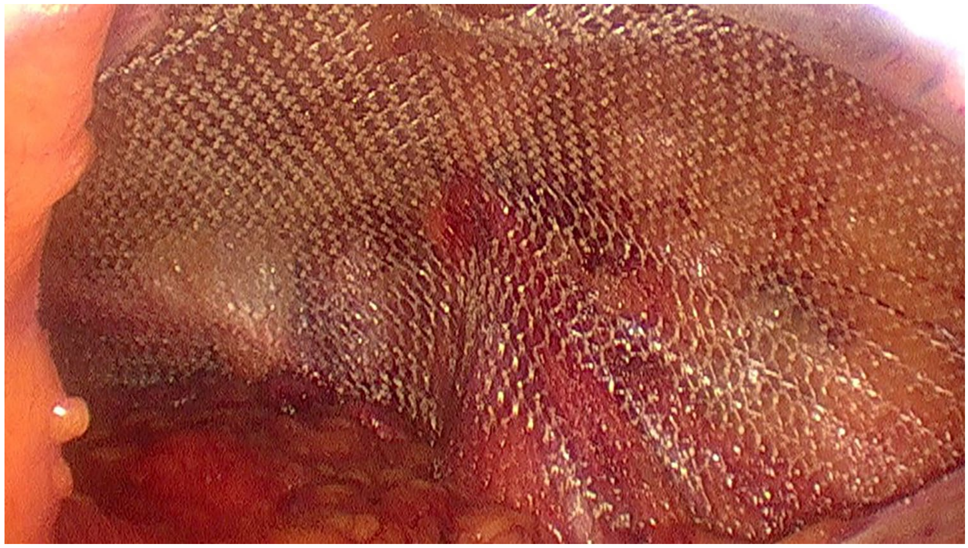

Fig. 3 Final mesh position. The mesh is 17 × 11 cm in size and has been placed without wrinkles or folding

Conclusion

The CVMPO score is a reliable tool for the evaluation of TAPP IHR. Implementing the CVMPO score facilitates objective assessment of the safety and quality of the procedure. Its utility as an educational tool may make the learning process of MI IHR easier. Application of the score should be extended to the operating room, skills laboratory, and video-recorded procedures, including other MI IHR techniques.

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Data availability The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Disclosures The authors declare that they have no conflict of interest.

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