

A new classification for seroma after laparoscopic ventral hernia repair

S. Morales-Conde

Received: 25 September 2011 / Accepted: 24 March 2012 / Published online: 17 April 2012
© Springer-Verlag 2012

Abstract

Introduction Laparoscopic techniques are being used increasingly in the repair of ventral hernias, but different incidences and complications have been described as potential risks of this approach. Seroma formation has been documented as one of the most common complication, although most of the time remains asymptomatic and it can be considered just an incident. The incidence of seroma after laparoscopic ventral hernia repair has not been properly documented and analyzed since the definition used by different authors is not the same from one series to another. We present a new classification of clinical seroma in order to try to establish the real incidence of this potential complication.

Clinical classification Clinical seromas could be detected during physical examination in many patients after LVHR, but in most of the cases they do not cause any problem or just a minimum discomfort that allows normal activity. Based on this fact and on the need of carrying out a medical or an invasive therapy to treat them, five groups can be established in order to classified this entity: Type 0, no clinical seroma (being 0a no seroma after clinical examination and radiological examinations and 0b those detected radiologically but not detected clinically); Type I, clinical seroma lasting less than 1 month; Type II (seroma with excessive duration), clinical seroma lasting

more than 1 month (being IIa between 1 and 3 months and IIb between 3 and 6 months); Type III (symptomatic seromas that may need medical treatment), minor seroma-related complications (seroma lasting more than 6 month, esthetic complaints of the patient due to seroma, discomfort related to the seroma that does not allow normal activity to the patient, pain, superficial infection with cellulites); and Type IV (seroma that need to be treated), mayor seroma-related complications (need to puncture the seroma, seroma drained spontaneously, applicable to open approach, deep infection, recurrence and mesh rejection). It is important to differentiate between a complication and an incident, being considered seroma as an incident if it is classified as seroma Type I or II, and a complication if it is included in group III and IV. The highest classification is the one that should be used in order to describe the type of seroma.

Conclusions Seroma is one of the most common complications after laparoscopic ventral hernia repair although its real clinical incidence is variable since it has been described in the literature following different parameters. It is observed in almost all cases by radiological examinations, but it is not determined if must be considered an incident or a complication. For these reasons, a new classification of seroma has been proposed in order to unify criteria among surgeons when describing their experience. This classification could be also used in the future to measure the effect of new methods proposed to reduce seroma formation to evaluate the incidence of seroma depending on the mesh used, and it could be also proposed to be used to describe the incidence of seroma after open ventral hernia repair.

Keywords Seroma · Laparoscopic · Ventral hernia · Complication · Classification

S. Morales-Conde (✉)
Unit of Innovation in Minimally Invasive Surgery,
University Hospital “Virgen del Rocío”, Betis-65, 1^o,
41010 Sevilla, Spain
e-mail: smoralesc@gmail.com

Introduction

Laparoscopic techniques are being used increasingly in the repair of abdominal wall hernias, and it is gaining popularity among minimally invasive surgeons, since this approach promise better results than open repair [1–3], such us shorter lengths of hospital stay, a decreased local morbidity compared to conventional open repair, specially surgical site infection [4], and better cosmetic results. On the other hand, it is not well defined if laparoscopic ventral hernia repair (LVHR) could offer lower recurrence rate than open approach (OVHR), although a systematic review of the literature published in 2008 shows results in favor of LVHR versus OVHR in terms of recurrence rate [2]

Different complications have been described as potential risks of LVHR [5, 6], such as enterotomy, intra-abdominal bleeding, postoperative ileus, delayed bowel injury, chronic pain, trocar-site hernia, late mesh infection, symptomatic mesh bulging, ranging their rate from one series to another. The definitions of the parameters used to set the rate of these complications are traditionally well stabilized, and they are based on objective facts. But on the other hand, seroma has been included in different series as one of the main complications of this approach, although the criteria used to evaluate its presence, or even to consider them a complication, have not been defined yet.

Incidence of seroma

Seroma formation has been documented as one of the most common complications after laparoscopic inguinal [7] and ventral hernia repair (Fig. 1), but in most of the cases these seromas must be considered just an incident since they do not cause any problems neither discomfort to patients. The real incidence of seroma after this procedure is difficult to be determined, not being properly documented and analyzed since its presence is highly variable from one series to another. Different studies have shown how the rate of seroma formation is as low as 0.5 % [8] ranging different series from 0.5 [8] to 78 % [9] (Table 1), being the rate described in the systematic review published by Bedi et al. of 5.4 % [10]. But these data are related to the presence of clinical seroma based on different criteria, since one of our studies and the study conducted by Susmallian et al. [11] show that seroma is present in radiological examinations in almost all cases (Table 2).

One of the main problems related to the variety of these results is that seromas have been considered following different criteria by different authors. For some authors, it is considered just a complication [12], for others it is considered one of the main complications of this technique [13], or even as the most common sequel of this surgery

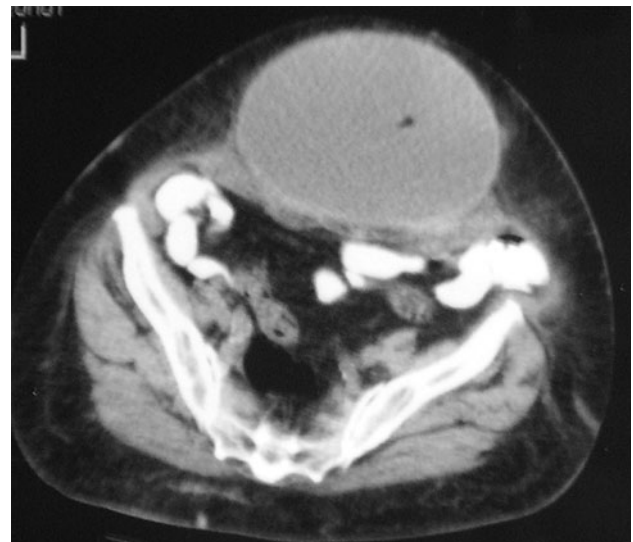


Fig. 1 Seroma after laparoscopic repair of a suprapubic hernia

Table 1 Clinical incidence of seroma alter laparoscopic ventral hernia repair

Author	Clinical seroma (%)
Parker et al. [8]	0.5
Morales-Conde et al. [5]	2.1
Heniford et al. [10]	2.6
Ferrari et al. [30]	2.6
Carbonell et al. [31]	2.7
Heniford et al. [18]	3
Edi et al. [32]	3.7
Bedi et al. [10] systematic review	5.4
Kaafarani et al. [20]	6.8
Uranues et al. [33]	7
Varnell et al. [21]	8.5
Tessier et al. [19]	9
Perrone et al. [13]	10.7
Farrakha et al. [34]	10.9
Sodergren et al. [23]	14.5
Sharma et al. [14]	25
Chowbey et al. [35]	32
Edwards et al. [22]	32.3
Susmallian et al. [11]	35
Birch et al. [9]	78

[14], but others just think it is a minor complication [3] or an incident [9].

On the other hand, an additional problem related to the definition of seroma is observed in most of the series: authors have been using different parameters to quantify the rate of seroma formation, or the ones used are difficult to be measured. Some authors have used the definition of “significant seroma” [15] or “prolonged seroma”, while

Table 2 Radiological incidence of seroma after laparoscopic ventral hernia repair

Author	Radiological seroma (%)
Morales-Conde	95.2
Susmallian et al. [11]	100

others describe seroma as a fluid retention that requires surgical intervention [16] or need to be punctured [17], or based on the time lasting after surgery, lasting more than 4 weeks [18], more than 6 weeks [19], or even more than 8 weeks [20], or even they are just defined them as “a symptomatic seroma” [21], or by the presence of complications such as seroma-related cellulites [22].

For that reason, we propose a clinical classification of seroma after LVHR in order to unify different criteria, so we can establish in the near futures in the surgical literature the proper incidence of seroma and the clinical importance of it (Table 3).

Importance of seroma formation

Seroma, defined as a serous fluid retention between the mesh and the anterior abdominal wall, is presence in most of the cases after LVHR, as different series that have analyzed its presence by radiological examination shows. Its presence cannot be considered a complication since patients do not even feel them in most of the cases. For these reasons, it is important to establish that seromas must be considered an incident after this surgery that may lead to complications.

The potential complications related to seroma formation include pain, discomfort to the patient, cellulites [22], being the most important complication of the possibility of getting infected. The infection of the seroma is considered one of the most challenging complications since it might lead to mesh removal [22] and recurrence [23].

The rate of cellulitis and infection also ranged from one series to another. Seroma-related cellulitis is considered by some authors to be a common problem that it is present in all the patients in whom a seroma is detected [22]. This cellulitis can lead to mesh infection, postoperative morbidity, and further need for operative care. Some authors have proposed the administration of 7 days of postoperative prophylactic antibiotics to decrease the rate of patients with seroma developing cellulitis [22].

Seroma after LVHR could also be related to recurrences. The weight of this serous fluid between the mesh and the anterior abdominal wall could increase the tensile strength at the fixation site of the mesh and therefore detach tackers (Fig. 2). This fact could be responsible of an inaccurate anchorage of the mesh right after surgery, which may influence the presence of recurrences in the future. In fact, some authors have observed at re-operation because of recurrence how they appeared to be due to mesh detachment, and this fact might be related to the presence of a seroma [23].

It is difficult to know, based on the literature, the best method to manage patients presenting seromas and their complications in the postoperative period. While some groups recommend puncturing the seroma just in case of pain or discomfort, other groups recommend not doing it in order to avoid contamination. Most of the authors considered spontaneous resolution of seroma occurs in the vast majority of the cases, being not necessary to puncture any of them or being very low the rate of those that need to be aspirated. But we have also detected in the literature that the reasons that lead different authors to puncture seromas and the complications of this invasive approach are not well defined. Based on this data, we have observed that the rate of seromas that are punctured ranges from one author to another, from 0 to 33.3 % [20, 24].

The real importance of seroma formation and the influence of them in the quality of life in the postoperative period of the patients also need to be determined. Analyzing our results, in which only 3 seromas (2.1 % of our

Table 3 Classification and definitions of clinical seromas after laparoscopic ventral hernia repair

Type of seroma	Definition	Clinical significance
0	No clinical seroma	No clinical seroma
I	Clinical seroma lasting <1 month	Incident
II	Clinical seroma lasting >1 month	
III	Symptomatic seroma that may need medical treatment: minor seroma-related complications	Complication
IV	Seroma that need to be treated: major seroma-related complications	

Clinical seroma those seromas detected during physical examination of patients, which do not cause any problem, or just a minimum discomfort that allows normal activity

Minor complication Important discomfort that does not allow normal activity to the patient, pain, superficial infection with cellulitis, esthetic complaints of the patient due to seroma or seroma lasting more than 6 months

Major complication Infection, recurrence, mesh rejection or need to be punctured

Fig. 2 Seroma could be related to recurrence, since it could desattach the tacks due to its weight



published series) need to be punctured due to discomfort to the patients with no further complications [17], we can conclude that seroma is not really a key factor in the postoperative period after this surgery and its simple presence cannot be considered a complication.

But it is our opinion that it would be better to avoid seromas since they could be responsible, in some cases, for some sort of discomfort to the patient and because they could also be responsible for confusion to both patients and surgeons about a possible recurrence.

Classification

We have classified clinical seroma into 5 groups, ranging from 0 to IV. We have to consider that, as we have described previously, the incidence of radiological seroma is almost present in a 100 % of the cases [11], being that reason what leads us to base this new classification just on clinical findings.

The first concept we have to establish is the definition of *non-complicated clinical seroma*, since it could be considered by different authors in different senses. *Non-complicated clinical seroma* could be defined as “those seromas detected during physical examination of the patient which do not cause any problem, or just a minimum discomfort that allows normal activity.” Based on this definition, and in the need of a medical, an invasive or a surgical therapy to treat them, the 5 groups (0 to IV) established are (Tables 3, 4):

- Type 0: no clinical seroma
 - Type 0a: neither clinical nor radiological seroma
 - Type 0b: no clinical seroma, but it can be detected by radiological examinations
- Type I: clinical seroma lasting less than 1 month.
- Type II: Clinical seroma lasting more than 1 month: seroma with excessive duration.
 - Type IIa: between 1 and 3 months
 - Type IIb: between 3 and 6 months
- Type III: Minor seroma-related complications: symptomatic seromas that may need medical treatment. Minor complications include:
 - Type IIIa: clinical seroma lasting more than 6 month
 - Type IIIb: Esthetic complaints of the patient due to seroma
 - Type IIIc: Important discomfort that does not allow normal activity to the patient
 - Type IIId: Pain
 - Type IIIe: Superficial infection with cellulitis
- Type IV: Mayor seroma-related complications: seromas that need to be treated. Mayor complications include:
 - Type IVa: Need to puncture the seroma to decrease symptoms
 - Type IVb: Seroma drained spontaneously (applicable to open approach)

Table 4 Sub-classification of clinical seromas after laparoscopic ventral hernia repair

Type 0	No clinical seroma		No clinical seroma
	0a	neither clinical nor radiological seroma	
	0b	no clinical seroma, but it can be detected by radiological exams	
Type I	Clinical seroma lasting less than 1 month.		INCIDENT
Type II	Clinical seroma lasting more than 1 month: seromas with excessive duration		
	IIa	between 1 and 3 month	
	IIb	between 3 and 6 month	
Type III	Minor seroma related-complications: symptomatic seromas that may need medical treatment		COMPLICATION
	IIIa	Clinical seroma lasting more than 6 month	
	IIIb	Esthetic complaints of the patient due to seroma	
	IIIc	Important discomfort which does not allow normal activity	
	IIId	Pain	
	IIIe	Superficial infection with cellulitis	
Type IV	Mayor seroma related-complication: seromas that need to be treated		
	IVa	Need to puncture the seroma to decrease symptoms	
	IVb	Seroma drained spontaneously (applicable to open approach)	
	IVc	Deep infection	
	IVd	Recurrence related to seroma	
	IVe	Mesh rejection related to seroma	

The highest classification is the one that should be used in order to describe the type of seroma. This classification could be also used for open ventral hernia repair.

- Type IVc: Deep infection
- Type IVd: Recurrence related to seroma
- Type IVe: Mesh rejection related to seroma

The reason why it has been established the division within group I and II in 1 month is because in a standard setting of follow-up most of these patients are reviewed 4–5 weeks after surgery, and seroma is being evaluated at that visit.

It is important to establish when a seroma would be considered an incident or a complication, since its importance would be totally different. Types I and II would be considered an incident, while Types III and IV would be considered a complication, since a medical or invasive therapy is necessary.

In Type IVa, we should also include other surgical treatments such as injection of talc or surgical excision (in case of absence of mesh infection/rejection or recurrence).

On the other hand, it is important to underline that the highest classification is the one that should be used; for example, short duration but a symptomatic seroma is Type III, and short duration but the seroma needs to be punctured should be classified as Type IV.

Discussion

There is a need in the literature to establish a new classification of seromas after LVHR since most authors use this term to define different clinical situations in the same way, which leads to confusion to determine their rate, adding also difficulties to evaluate the effectiveness of the different methods proposed to avoid seroma formation. In this

sense, different methods have been described to decrease the rate of this serous fluid between the mesh and the sac, such as cauterization of the hernia sac [25, 26], use of argon bean or to excise it, and to decrease the seroma-related complications, such as the use of postoperative antibiotics to decrease the incidence of seroma-related cellulites in order to decrease the possibility of mesh removal due to this problem [22]. Other authors have proposed that defect closure confers a strong advantage in LVHR, since there is a shift of the paradigm toward more physiologic abdominal wall reconstruction, while providing reliable hernia repair, the addition of defect closure in these patients essentially eliminated postoperative seroma. These authors advocate routine use of the closure of the defect technique during LVHR [15]. But for other authors, such as Palanivelu et al. [12], this maneuver of closing the defect seems to have no influence in the rate of seroma formation.

The evaluation of the effectiveness of these techniques is not the same from one study to another, since the definition used is different by different authors. Since new methods and new studies should be conducted to try to decrease the incidence of these seromas, it would be very important to base the results on this classification, which will help surgeons to better understand the effectiveness of the different methods used to decrease this local incident or complication.

On the other hand, since most of seromas are asymptomatic, there is a need to determine when a seroma would be considered just an incident or a complication. Some series include in the morbidity associated with LVHR the rate of seroma, being most of them just an incident since they can just be detected in the physical examination of the

patient, being otherwise asymptomatic. This new classification will be very useful for surgeons in order to determine the percentage of seroma after LVHR that can be considered an incident, which will show a more realistic morbidity rate after this procedure.

Finally, we consider that this new classification could also be used to evaluate the presence of seroma after conventional open ventral hernia repair, since the same criteria can be followed in order to describe and evaluate this local incident or complication. In fact, it is necessary to evaluate the true incidence of seroma when the open and the laparoscopic approach is compared. Different prospective studies show different results, such as the study from Pring et al. [27] in which the rate of seroma is similar among the two approaches, or the study from Barbados et al. [3], in which seroma is more frequent after LVHR, or the study from Kaafarani et al. [20] in which seroma is more frequent after the open approach. On the other hand, there are also different studies [28] and a systematic review on mesh being used for LVHR [29], which compare the incidence of seroma depending on the mesh placed intraperitoneally, being also useful to establish the rate of seroma based on similar criteria.

As a conclusion, it can be said that seroma is one of the most common worries for surgeons that occurs after LVHR, although its real clinical incidence is variable since it has been described in the literature following different parameters. Seromas are observed in almost all cases by radiological examinations, but it is not determined whether they must be considered an incident or a complication. For these reasons, a new classification of seroma has been proposed in order to unify criteria among surgeons when describing their experience. This classification could be also used in the future to measure the effect of new methods proposed to reduce seroma formation to evaluate the incidence of seroma depending on the mesh used, and it could be also proposed to be used to describe the incidence of seroma after open ventral hernia repair.

References

- Morales-Conde S, Abdel-Lah A, Angoso-Catalina F, Blasco F, Feliu-Pala X, Fernandez-Lobato R, Gonzalez de Francisco T, Guerrero Fernandez-Marcote JA, Martin-Gomez M, Martinez-Garcia F, Morales-Mendez S, Murillo J, Oliva H, Pina J, Planellas X, Robres J, Rodero D, Ruiz-Castillo J, Serrantes-Gomez A, Tovar-Martinez JL, Tuca F, Utrera A, GRRETHAL (Grupo Espanol para el Estudio del Tratamiento de las Hernias Abdominales por Laparoscopia) (2005) Expert opinion on the basic surgical technique for laparoscopic ventral hernia repair. *Cir Esp* 78:214–221
- Misiakos EP, Machairas A, Patapis P, Liakakos T (2008) Laparoscopic ventral hernia repair: pros, cons compared with open hernia repair. *JLS* 12:117–125
- Barbaros U, Asoglu O, Seven R, Erbil Y, Dincag A, Deveci U, Ozarmagan S, Mercan S (2007) The comparison of laparoscopic, open ventral hernia repairs: a prospective randomized study. *Hernia* 11:51–56
- Kaafarani HM, Kaufman D, Reda D, Itani KM (2010) Predictors of surgical site infection in laparoscopic, open ventral incisional herniorrhaphy. *J Surg Res* 163:229–234
- Morales-Conde S (2004) Laparoscopic ventral hernia repair: advances and limitations. *Semin Laparosc Surg* 11:191–200
- Schoenmaeckers EJ, Raymakers JF, Rakic S (2010) Complications of laparoscopic correction of abdominal wall, incisional hernias. *Ned Tijdschr Geneesk* 154:A2390
- Cihan A, Ozdemir H, Ucan BH, Acun Z, Comert M, Tascilar O, Cesur A, Cakmak GK, Gundogdu S (2006) Fade or fate. Seroma in laparoscopic inguinal hernia repair. *Surg Endosc* 20:325–328
- Parker HH III, Nottingham JM, Bynoe RP, Yost MJ (2002) Laparoscopic repair of large incisional hernias. *Am Surg* 68:530–533
- Birch DW (2007) Characterizing laparoscopic incisional hernia repair. *Can J Surg* 50:195–201
- Bedi AP, Bhatti T, Amin A, Zuberi J (2007) Laparoscopic incisional, ventral hernia repair. *J Minim Access Surg* 3:83–90
- Susmallian S, Gewurtz G, Ezri T, Charuzi I (2001) Seroma after laparoscopic repair of hernia with PTFE patch: is it really a complication? *Hernia* 5:139–141
- Palanivelu C, Jani KV, Senthilnathan P, Parthasarathi R, Madhankumar MV, Malladi VK (2007) Laparoscopic sutured closure with mesh reinforcement of incisional hernias. *Hernia* 11:223–228
- Perrone JM, Soper NJ, Eagon JC, Klingensmith ME, Aft RL, Frisella MM, Brunt LM (2005) Perioperative outcomes, complications of laparoscopic ventral hernia repair. *Surgery* 138:708–715
- Sharma A, Mehrotra M, Khullar R, Soni V, Baijal M, Chowbey PK (2001) Laparoscopic ventral/incisional hernia repair: a single centre experience of 1, 242 patients over a period of 13 years. *Hernia* 15:131–139
- Orenstein SB, Dumeer JL, Monteagudo J, Poi MJ, Novitsky YW (2011) Outcomes of laparoscopic ventral hernia repair with routine defect closure using “shoelacing” technique. *Surg Endosc* 25:1452–1457
- Rosenberg J, Burcharth J (2008) Feasibility and outcome after laparoscopic ventral hernia repair using proceed mesh. *Hernia* 12:453–456
- Morales-Conde S, Cadet H, Cano A, Bustos M, Martin J, Morales-Mendez S (2005) Laparoscopic ventral hernia repair without sutures—double crown technique: our experience after 140 cases with a mean follow-up of 40 months. *Int Surg* 90:S56–S62
- Heniford BT, Park A, Ramshaw BJ, Voeller G (2003) Laparoscopic repair of ventral hernias: nine years’ experience with 850 consecutive hernias. *Ann Surg* 238:391–399
- Tessier DJ, Swain JM, Harold KL (2006) Safety of laparoscopic ventral hernia repair in older adults. *Hernia* 10:53–57
- Kaafarani HM, Hur K, Hirter A, Kim LT, Thomas A, Berger DH, Reda D, Itani KM (2009) Seroma in ventral incisional herniorrhaphy: incidence, predictors, outcome. *Am J Surg* 198:639–644
- Varnell B, Bachman S, Quick J, Vitamvas M, Ramshaw B, Oleynikov D (2008) Morbidity associated with laparoscopic repair of suprapubic hernias. *Am J Surg* 196:983–987
- Edwards C, Angstadt J, Whipple O, Grau R (2005) Laparoscopic ventral hernia repair: postoperative antibiotics decrease incidence of seroma related cellulites. *Am Surg* 71:931–935
- Sodergren MH, Swift I (2010) Seroma formation, method of mesh fixation in laparoscopic ventral hernia repair—highlights of a case series. *Scand J Surg* 99:24–27
- Berrevet F, Fierens K, De Gols J, Navez B, Van Bastelaere W, Meir E, Ceulemans R (2009) Multicentric observational cohort

- study evaluating a composite mesh with incorporated oxidized regenerated cellulose in laparoscopic ventral hernia repair. *Hernia* 13:23–27
25. Tsimoyiannis EC, Siakas P, Glantzounis G, Koulas S, Mavridou P, Gossios KI (2001) Seroma in laparoscopic ventral hernioplasty. *Surg Laparosc Endosc Percutan Tech* 11:317–321
 26. Appeltans BM, Zeebregts CJ, Cate Hoedemaker HO (2000) Laparoscopic repair of a Spigelian hernia using an expanded polytetrafluoroethylene (ePTFE) mesh. *Surg Endosc* 14:1189
 27. Pring CM, Tran V, O'Rourke N, Martin IJ (2008) Laparoscopic versus open ventral hernia repair: a randomized controlled trial. *ANZ J Surg* 78:903–906
 28. Biondi A, Tropea A, Monaco G, Musmeci N, Zanghi G, Basile F (2010) Complications in the laparoscopic treatment of primary, secondary hernias of the abdominal wall. *Ann Ital Chir* 81:193–198
 29. Eriksen JR, Gögenur I, Rosenberg J (2007) Choice of mesh for laparoscopic ventral hernia repair. *Hernia* 11:481–492
 30. Ferrari GC, Miranda A, Sansonna F, Magistro C, Di Lernia S, Maggioni D, Franzetti M, Costanzi A, Pugliese R (2009) Laparoscopic repair of incisional hernias located on the abdominal borders: a retrospective critical review. *Surg Laparosc Endosc Percutan Tech* 19:348–352
 31. Carbonell AM, Kercher KW, Matthews BD, Sing RF, Cobb WS, Heniford BT (2005) The laparoscopic repair of suprapubic ventral hernias. *Surg Endosc* 19:174–177
 32. Eid GM, Prince JM, Mattar SG, Hamad G, Ikramuddin S, Schauer PR (2003) Medium-term follow-up confirms the safety, durability of laparoscopic ventral hernia repair with PTFE. *Surgery* 134:599–603
 33. Uranues S, Salehi B, Bergamaschi R (2008) Adverse events, quality of life, recurrence rates after laparoscopic adhesiolysis, recurrent incisional hernia mesh repair in patients with previous failed repairs. *J Am Coll Surg* 207:663–669
 34. Farrakha M (2006) Laparoscopic ventral hernia repair using expanded polytetrafluoroethylene-polyester mesh compound. *Surg Endosc* 20:820–823
 35. Chowbey PK, Sharma A, Khullar R, Mann V, Baijal M, Vashistha A (2000) Laparoscopic ventral hernia repair. *J Laparosc Adv Surg Tech A* 10:79–84