



Original article

Abdominal wall closure: How do we do it in Spain? Survey of specialist general surgeons members of the AEC (Spanish Society of Surgeons)

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Objectives: To evaluate the knowledge of abdominal wall closure in a cohort of specialist general surgeons who are members of the AEC and to see its adequacy with current recommendations. Sub-analysis in terms of years of specialization.

Material and methods: Individual questionnaire of 21 questions on abdominal wall closure in elective and urgent context.

Results: A total of 371 responses were received from specialist surgeons who are members of the AEC. Closure of the median laparotomy is performed with continuous suture in 99.7% and with slowly absorbable materials in 95.4%. 88.4% of surgeons report using the ratio equal to or greater than 4:1 between suture length and incision length (SL:IL) and short stitches. These results are equivalent in transverse and urgent elective laparotomy. 85.2% of the respondents systematically close trocars of 10 mm or more and 30.7% use prophylactic mesh in high-risk patients. Surgeons with less than 10 years of experience use the ratio $\geq 4:1$ SL:SI and short stitches more than surgeons with more experience (93.4% vs 84.9%; $P = .013$).
Conclusions: Abdominal wall closure among general surgeons who are members of the ACS is adequate and adjusted to the recommendations with a tendency to improve among surgeons with less experience. There is an opportunity for improvement in the use of prophylactic mesh in high-risk patients.

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Cierre de pared abdominal: ¿cómo lo hacemos en España? Encuesta a cirujanos generales especialistas miembros de la AEC (Asociación Española de Cirujanos)

R E S U M E N

Palabras clave:

Cierre pared abdominal
Encuesta
Hernia incisional
Malla profiláctica

Objetivos: Evaluar el conocimiento de cierre de pared abdominal en una cohorte de cirujanos generales especialistas miembros de la AEC y ver su adecuación con las recomendaciones actuales. Subanálisis en cuanto a años de especialización.

Material y métodos: Cuestionario individual de 21 preguntas de cierre de pared abdominal en contexto electivo y urgente.

Resultados: Se han recibido un total de 371 respuestas de cirujanos especialistas miembros de la AEC. El cierre de laparotomía media se realiza con sutura continua en un 99,7% y con materiales de absorción lenta en un 95,4%. Un 88,4% de los cirujanos refiere utilizar la relación igual o superior a 4:1 entre la longitud de la sutura y la longitud de la incisión (LS:LI) y puntos cortos. Dichos resultados son equivalentes en laparotomía electiva transversa y urgente. Un 85,2% de los encuestados cierran los trócares de 10 o más milímetros sistemáticamente y un 30,7% utilizan malla profiláctica en pacientes de alto riesgo. Los cirujanos con menos de 10 años de experiencia utilizan más la relación $\geq 4:1$ LS:LI y puntos cortos (93,4% vs 84,9%; $P = ,013$).

Conclusiones: El cierre de la pared abdominal entre los cirujanos generales miembros de la AEC es adecuado y ajustado a las recomendaciones con una tendencia a mejorar entre los cirujanos con menor experiencia. Existe oportunidad de mejora en el uso de malla profiláctica en pacientes de riesgo.

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Introduction

The rate of incisional hernia is not negligible, being 12.8% at 24 months in a systematic review and meta-regression study that includes 14,000 patients.¹ Presentation of an incisional hernia leads to poorer quality of life and increased healthcare costs.^{2,3} Furthermore, the subsequent repair of an incisional hernia will entail possible hernia recurrence of between 13% and 35%, depending on follow-up, a percentage that increases with each new repair.⁴⁻⁶

Against this backdrop, our efforts must focus on prophylaxis of the appearance of incisional hernia, starting with good closure of the abdominal wall. This review of abdominal wall closure is based on the recommendations on wall closure issued by the European Hernia Society in 2015 and its subsequent joint update with the European and American Hernia Society in 2022.^{7,8} The recommendations issued are as follows: (1) closure of the elective midline laparotomy with continuous suture with slow-absorbing monofilament, applying the ratio equal to or greater than 4:1 between the length of the suture and the length of the incision (LS:LI) and also using short stitches (also known in the literature as “small bites,” which consist of making stitches 5 mm apart from the midline and 5 mm between stitches)⁹; (2) closure of the laparoscopic trocar holes whenever they are 10 or more millimetres; (3) use of prophylactic mesh in at risk patients, understanding at risk patients to be those with abdominal aortic aneurysm or those who are obese. There are no recommendations regarding the closure of elective transverse laparotomy, nor regarding the type of closure of trocar holes or emergency laparotomies, nor

is there sufficient evidence to make recommendations regarding the calibre of the suture or the size of the needle used for closure.

Objectives

To assess the knowledge of elective and emergency abdominal wall closure in a cohort of specialist general surgeons who are members of the AEC and to analyse the degree of adequacy in relation to the referenced abdominal wall closure guidelines. Sub-analysis to be made regarding years of specialisation of the surgeons participating in the survey.

Material and methods

A survey of 21 multiple-choice questions, without the possibility of free response, about abdominal wall closure in all types of laparotomies and in elective and emergency contexts was distributed online and through the AEC to specialist general surgeons who were members of the AEC.

The survey was distributed twice. The first distribution was made on 06/05/2024 and closed on 03/06/2024 to all AEC members who gave their consent to receive communications: 2936 members. The second distribution was made on 03/06/2024 until 20/06/2024, only to AEC members who gave their consent and who were also registered in the AEC Abdominal Wall Section: 1058 registered members.

The survey consisted of five blocks of questions on abdominal wall closure in (1) elective midline laparotomy,

Table 1 – First survey block: elective midline laparotomy.

Survey question	Multiple response	n (%) ‡	% Adequacy †
1. Type of closure	Continuous	370 (99.7%)	99.7% adequacy
	Loose sutures	1 (.3%)	
2. Suture material	Non absorbable	5 (1.3%)	95.4% adequacy
	Short lasting absorbable	7 (1.9%)	
	Long lasting absorbable	354 (95.4%)	
	Other	5 (1.3%)	
3. Suture calibre	1	79 (21.3%)	No recommendation
	0	105 (28.3%)	
	2/0	185 (49.9%)	
	Other	2 (.5%)	
4. Ratio \geq 4:1 LS:LI and short stitches	Yes	328 (88.4%)	88.4% adequacy
	No	43 (11.6%)	

‡ n = number of surgeons surveyed with the mentioned response (%) in brackets the percentage they represent of the total.
† Adequacy of the closure measure recommended in the Abdominal Wall Closure Guidedelines.^{7,8}

(2) elective transverse laparotomy or laparoscopic assistance, (3) trocar holes, (4) prophylactic mesh in risk situations and (5) emergency laparotomy (Appendix 1).

Results

In the first round of the survey a total of 249 responses were received (8.48% of those requested) and in the second round, 122 (11.53%). A total of 371 specialist AEC member surgeons responded to the survey. Fifty-nine per cent of the surgeons who responded to the survey had over 10 years' experience as a specialist. Respondent distribution in terms of the subspecialty was as follows: 44% Abdominal Wall; 21% Colorectal; 11% Oesophagogastric and Bariatric; 9% Hepatobiliary-pancreatic; 8% Emergencies; 4% Breast, and 3% Endocrine.

First and second survey blocks: elective laparotomy closure

Tables 1 and 2 describe the results of the survey on elective laparotomies (midline and transverse), with continuous closure being the preferred choice (99.7% and 96.2%, respectively), with slow-absorbing suture in more than 90% of cases, and the suture size chosen by half of the surgeons being 2/0.

Table 2 – Second survey block: transverse or laparoscopic-guided incision laparotomy closure.

Survey question	Multiple response	n (%) ‡
1. Type of closure	Continuous	357 (96.2%)
	Loose sutures	14 (3.8%)
2. Suture material	Non absorbable	6 (1.6%)
	Short lasting absorbable	22 (5.9%)
	Long lasting absorbable	335 (90.3%)
	Other	8 (2.2%)
3. Suture calibre	1	67 (18.1%)
	0	113 (30.5%)
	2/0	189 (50.9%)
	Other	2 (.5%)
4. Ratio \geq 4:1 LS:LI and short stitches	Yes	319 (86.0%)
	No	52 (14.0%)

‡ n = number of surgeons surveyed with the mentioned response (%) in brackets the percentage they represent of the total.

The ratio \geq 4:1 LS:LI and short stitches were used by more than 85% of the respondents. The left-hand column of Table 1 records the percentages of recommendations of the referenced guidelines. Table 2 does not include the percentage of adequacy, since no recommendations are issued in the guidelines for this type of laparotomy. In any event, the type of closure and the material used are super-imposable with that of elective midline laparotomy.

Third survey block: trocar hole closure

Regarding the closure of trocar holes measuring 10 mm or more, this was systematically performed by 85.2% of surgeons, with loose sutures of long-lasting absorbable material in 49.9% of respondents, with a 0 calibre in the majority (Table 3). With respect to trocar holes themselves, the referenced guidelines only recommend that trocar holes measuring 10 mm or more should be closed, but do not specify how they should be closed.

Fourth survey block: prophylactic mesh use in risk situations

Prophylactic mesh in patients at high risk of incisional hernia is applied by 30.7% of respondents. In this section, the referenced clinical guidelines only indicate patients with abdominal aortic aneurysms or obesity as risk factors for the adoption of prophylactic mesh.

Fifth survey block: emergency laparotomy closure

Regarding emergency laparotomies, 90.6% of the surgeons surveyed did not change their usual clinical practice, closing with continuous suture in 98.9% and with long-lasting absorbable material in 94.1%. The clinical guidelines do not issue recommendations on the closure of emergency laparotomies.

Closure based on years of specialisation and sub-specialisation in abdominal wall surgery

If we perform a sub-analysis based on the years of specialist experience of the surveyed surgeons, surgeons with less than or 10 years of professional practice as a specialist more frequently close elective midline laparotomies

Table 3 – Third survey block: trocar hole closure.

Survey questions	Multiple response	n (%) ‡	% Adequacy †
1. Systematic closure > 10 mm	Yes	316 (85.2%)	85.2% adequacy
	No	55 (14.8%)	
2. Type of closure	Continuous	79 (21.3%)	No recommendation
	Loose sutures	292 (78.7%)	
3. Suture material	Non absorbable	3 (.8%)	No recommendation
	Short lasting absorbable	174 (46.9%)	
	Long lasting absorbable	185 (49.9%)	
	Other	9 (2.4%)	
4. Suture calibre	1	77 (20.8%)	No recommendation
	0	164 (44.2%)	
	2/0	126 (34.0%)	
	Other	4 (1.1%)	
5. Ratio 4:1 LS:LI and short stitches	Yes	121 (32.6%)	No recommendation
	No	250 (67.4%)	

‡ n = number of surgeons surveyed with the mentioned response (%) in brackets the percentage they represent of the total.

† Adequacy of the closure measure recommended in the Abdominal Wall Closure Guidelines, there is only a recommendation on the first page of this block.^{7,8}

following the $\geq 4:1$ LS:LI ratio and short stitches than surgeons with more than 10 years and it would seem that they preferred finer suture sizes of 2/0, on more occasions, although this is not statistically significant. No significant differences were observed in the systematic closure of trocar holes measuring 10 mm or more, nor in the use of prophylactic mesh (Table 4).

In the sub-analysis according to the main dedication to abdominal wall surgery, which corresponds to 44% of the respondents, there were no statistically significant differences in any of the fields analysed: continuous closure (99.4% vs. 100%), long absorption (94.5% vs. 96.1%), $\geq 4:1$ LS:LI ratio and short stitches (87.1% vs. 89.4%), closure of trocar holes ≥ 10 mm (84.0% vs. 88.1%) or prophylactic mesh (28.2% vs. 32.6%).

Discussion

The main finding of the study was the very high level of compliance with the referenced guidelines in the closure of elective midline laparotomy among the specialist general surgeons surveyed, regardless of their specialty in abdominal

wall surgery. These results are much better than those reported 10 years ago in a similar cohort in Spain in which only 57% of surgeons used slow-absorbing sutures and only 43% used a $\geq 4:1$ LS:LI ratio for closure, not to mention that up to 66% of surgeons used full sutures in emergency midline laparotomy.¹⁰ Furthermore, there appears to be a trend towards less experienced surgeons having better training in abdominal wall closure, with a significant percentage of surgeons with less than 10 years of experience using a $\geq 4:1$ LS:LI ratio and short stitches for closure (93.4% vs 84.9%; $P = .013$). We believe that this improvement has been due to a greater awareness among general surgeons in abdominal wall closure, supported by a wide range of courses offered by the AEC in Abdominal Wall Closure Training for first-year residents. Although it is not possible to know the number of respondents who had taken the courses, since 2014, approximately 250 residents have been trained per year, spread across 12 locations, which would correspond approximately to the number of General Surgery positions offered in Spain per year, so a large number of residents since 2014 would have received the training. The results of our survey are comparable to other more recent surveys in Europe and the United States,¹¹⁻¹³ as well as at state level^{14,15} (Table 5).

Table 4 – Monitoring recommendations based on the years of experience of the surveyed surgeons.

Aspects in the different survey blocks with recommendations in the guidelines regarding Abdominal Wall Closure, based on the years of experience of the specialist surveyed

	Less than or 10 years as a specialist n = 152 (%) ‡	More than 10 years as a specialist n = 219 (%) ‡	P †
Elective midline laparotomy with continuous sutures	152 (100%)	218 (99.5%)	.404 (N.S.)
Elective midline laparotomy with long-lasting absorbable sutures	146 (96.1%)	208 (94.9%)	.941 (N.S.)
Elective midline laparotomy with 2/0 calibre sutures	84 (55.2%)	101 (46.1%)	.083 (N.S.)
Midline laparotomy with ratio $\geq 4:1$ LS:LI and short stitches	142 (93.4%)	186 (84.9%)	.013 *
Systematic trocar hole closure ≥ 10 mm	124 (81.6%)	192 (87.6%)	.104 (N.S.)
Use of prophylactic mesh in at risk patients	46 (30.3%)	68 (31.1%)	.909 (N.S.)

‡ n = number of surveyed surgeons (%) percentage of surgeons who answered the survey with a response in accordance with the main wall closure guidelines.

† A chi-square test has been applied for the qualitative analysis of variables, considering statistically significant differences with $P \leq .05$: (*) statistically significant; (N.S.) no statistically significant differences.

Table 5 – Summary of abdominal wall closure survey studies.

Author (year)	Location	Type of laparotomy	Specialty of the survey participants	Number of surgeons who responded	Number of questions	Degree of compliance of the respondents' responses to the recommendations of the main Abdominal Wall Closure guidelines, describing the number of respondents who answered correctly. (N.P.) Question not asked in the aforementioned survey.				
						Elective midline laparotomy continuous	Elective midline laparotomy Long-lasting reabsorbable	Use of 4/1 ratio and short stitches	Systematic trocar hole closure of more than 10 mm	Use of prophylactic mesh in at risk patents
Pereira ⁹ (2013)	Catalonia	Midline and transverse (Elective)	General surgery (specialists and resident physicians)	140	20	80%	57%	Ratio 4/1:43% Short stitches :N.P.	N.P.	37%
Fischer ¹⁰ (2019)	USA and Europe	Midline and transverse (Elective)	General surgery, 75% vascular and urology surgeons and 25% gynaecology	497	14	80.8%	80.8%	Ratio 4/1:78.7% Short stitches:71.8%	N.P.	15.3%
Bloemen ¹¹ (2019)	Holland	Midline (Elective)	General surgery (specialists and resident physicians)	402	24	98%	93%	Ratio 4/1:36% Short stitches:17%	N.P.	N.P.
Paulsen ¹² (2020)	Denmark	Low midline (Elective)	Gynaecology and general surgery	252	18	N.P.	N.P.	N.P.	N.P.	N.P.
Pereira ¹³ (2021)	Catalonia	Midline (Elective)	General surgery, vascular and urology (specialists and resident physicians)	44	11	74.8%	83.9%	Ratio 4/1:51.8% Short stitches:81.7%	N.P.	81.6%
Pous-Serrano ¹⁴ (2023)	Spain	Midline, transverse and trocar (Elective and emergency)	General surgery (sub-speciality in colorectal surgery)	53	25	96.2%	100%	84.9%	50.9%	24.5%
Juvany (2024)	Spain	Midline, transverse and trocar (Elective and emergency)	General surgery (specialists)	371	21	99.7%	95.4%	84%	85.2%	30.7%

Regarding the calibre of the suture material used, although it has been demonstrated in three clinical trials that closure with short stitches is correlated with a lower eventration rate, there is no evidence regarding which calibre of the suture material should be the most appropriate. In all three trials long-lasting absorbable suture materials of 2/0/0¹⁶⁻¹⁸ were used. The use of 2/0 calibre material is around 50% in the closure of all laparotomies, with an increasing tendency being observed among less experienced surgeons, although without statistical differences (55.2% vs 46.1%; $P = .083$). Although to date there is no direct and clear clinical evidence regarding the calibre of the suture material, we think that it could be a point to be taken into account among general surgeons.

Regarding trocar hole closure, 85.2% of the surgeons surveyed systematically close holes of 10 or more millimetres. This is of some concern since 14.8% of surgeons do not close them, bearing in mind that the rate of incisional trocar hernia may reach 25%–27% at and 1.5 and 3 years follow-up with trocar closure of short-duration absorbable material.^{19,20} As a result, it is particularly important to pay attention when placing trocars and in their appropriate closure.²⁰ The type of material used to close trocar holes could also be a matter of debate, since although there is not enough evidence to recommend any slow-absorbing material, it would be expected that, as with the closure of elective midline laparotomy, this could help to reduce the rate of incisional hernias of trocar holes. Despite this, only 49.9% of surgeons close trocar holes with long-lasting absorbable material.

Finally, perhaps the most controversial issue in the survey results is that 69.3% of the surgeons surveyed admit not using prophylactic mesh in patients at high risk of eventration. Although this mesh use is low, the percentage is higher than in the survey carried out among surgeons in the United States and Europe in which only 15.3% used prophylactic mesh in patients at risk.¹⁰ There is sufficient evidence that the use of prophylactic mesh is cost-effective in most studies and does not significantly increase complications of clean/contaminated elective surgery,²¹ and a non-absorbable synthetic mesh can be used safely in both elective and emergency surgery, significantly reducing the rate of incisional hernia, both in elective surgery²²⁻²⁵ and in emergency surgery.²⁶⁻²⁹

The main limitation of the study is the low 12.6% response rate among surgeons to whom the survey was sent. However, it would seem that the low response rate of most of this type of online survey would not greatly affect the validity of the results.³⁰

Conclusions

The closure of the abdominal wall among the general surgeons who are members of the AEC in Spain is adequate and matches guideline recommendations, with there being a tendency to improve among less experienced surgeons. The point that generates the most controversy is the use of prophylactic mesh in patients at risk. We observe a growing interest among general surgeons in the correct closure of the abdominal wall that will very probably translate into a lower incidence of incisional hernia in a few years. And we must not forget that

the best treatment of incisional hernia is precisely this, its prevention.

Declaration of competing interest

None.

Appendix 1 Members of the Board of the AEC Abdominal Wall Section

- Julio Gómez-Menchero
- Salvador Pous-Serrano
- Belen Porrero
- Carles Olona
- Antonio Ríos
- Jacobo López-Trebol
- Alberto López-Farías
- Luís Tallón-Aguilar
- Pilar Hernández-Granados
- Manuel López-Cano

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.cireng.2024.12.004>.

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