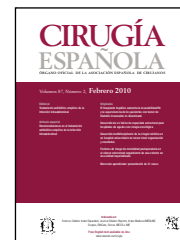




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Special article

Single incision laparoscopic surgery

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A B S T R A C T

One of the aims of the new technologies and techniques in minimally invasive surgery (MIS) is to achieve a surgery without or with minimal visible scars.

Natural orifice transluminal endoscopic surgery (NOTES) might be considered to be a paradigm of this development but it has not yet been possible to implement this universally.

Nevertheless, the resultant innovation of research into NOTES has enabled "bridge technologies" to be introduced that allow MIS to be developed with the required standards of efficiency and safety.

The aim of this paper is to review the concept of single incision surgery and to classify the available tools for its development and implementation.

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Cirugía laparoscópica a través de incisión única

R E S U M E N

Uno de los objetivos de las nuevas tecnologías y técnicas en cirugía mínimamente invasiva es lograr una cirugía sin o con mínimas cicatrices visibles.

La cirugía a través de orificios naturales podría considerarse como un paradigma de este desarrollo pero todavía no ha sido posible su completa implantación.

Sin embargo, la innovación resultante de la investigación en cirugía a través de orificios naturales ha permitido introducir una serie de «tecnologías puente» que permiten desarrollar la cirugía mínimamente invasiva con los estándares de eficacia y seguridad exigibles, siendo la cirugía laparoscópica a través de incisión única el concepto más atractivo en este momento.

El objetivo de este trabajo es revisar el concepto de cirugía laparoscópica a través de incisión única y clasificar las herramientas disponibles para su implantación y desarrollo.

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Palabras clave:

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Cirugía laparoendoscópica de sitio único

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Introduction

In the last 3 years, the expansion of new techniques and technologies in the field of minimally invasive surgery (MIS) has focused its efforts on one of the main ideals in current surgical progress: surgery with no visible scars.

Surgery with minimal or zero trauma to the abdominal wall would entail all of the advantages of MIS, at least in theory. Within this context, natural orifice transluminal endoscopic surgery (NOTES) could be considered as a paradigm for MIS development. But although the feasibility and safety of these techniques has been proven in clinical settings, its complete integration and development in health systems has not been possible due to an incomplete response to questions that have been planted regarding its use.^{1,2}

However, the innovation stemming from NOTES research has allowed the introduction of a series of "bridge technology" that has led to the development of MIS with high standards of efficacy and safety, with single-incision surgery being the most attractive surgical concept in current research (Figure).

The aim of this study is to review single-incision surgery and to classify the tools available for its implementation and development.

Nomenclature

A high level of confusion exists with regard to the nomenclature used in relation to this type of surgery, as several different techniques have been described that make reference to the use of a single incision, one single trocar, or transumbilical access (Table 1).³ Recently, the Laparoendoscopic Single-Site Surgery Consortium for Assessment and Research came to the conclusion that the term LESS surgery is the most apt for encompassing the philosophy and practical aspects of this approach.⁴ Finally, the term single incision laparoscopic surgery is probably appropriate for referring to this type of approach in our language, leaving the term single port multichannel access for those devices that employ its use.

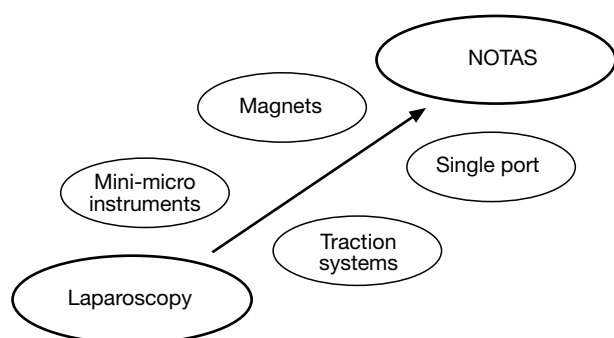


Figure – Development of minimally invasive surgery and bridge technology. NOTES indicates natural orifice transluminal endoscopic surgery.

Table 1 – Nomenclature

<i>Single incision</i>	
SILS	Single-incision laparoscopic surgery
LESS	Laparoendoscopic single-site surgery
SSL	Single-site laparoscopy surgery
<i>Single device</i>	
SPA	Single-port access
SLAPP	Single laparoscopic port procedure
SPLS	Single-port laparoscopic surgery
SPL	Single-port laparoscopy
<i>Umbilical access</i>	
OPUS	One-port umbilical surgery
TUES	Trans-umbilical endoscopic surgery
eNOTES	Embryological NOTES
NOTUS	Natural orifice transumbilical surgery
NOTES indicates natural orifice transluminal endoscopic surgery.	

Technology

Access devices

At present, the accessibility of these devices is not universal, with many of them still in the development, improvement, or commercial promotion stages. In our country, SILS® (Covidien, Autosuture, Hamilton, Bermuda) and TriPort® (Advanced Surgical Concepts; Whilock; Bray; Ireland) devices are available, along with various trocars for use in single incision multiport techniques. Table 2 displays the devices that have been developed and their main characteristics.

In general, all devices are multichannel ports with various types of valves (plastic, gel, paste). Due to its novel design, the Airseal® device deserves a special mention. This device uses a continuous positive pressure chamber that exceeds the pressure of the pneumoperitoneum and serves as a valve for instrument insertion.

Imaging

The size of the incision and the use of a single port with multiple accesses limit the possibility of navigation due to the reduced space in which the laparoscope and instruments have to work in. Developers have attempted to reduce this problem by using various types of laparoscopes. Probably, a simple 5mm laparoscope with 30° vision is the most versatile device that currently exists for single port surgery.

Other laparoscopes exist that are much more complex and supply advantages such as the interchangeable optical viewing angles of the Endo Chameleon® (Karl Storz GmbH & Co. KG, Tuttlingen, Germany), and the flexible point laparoscope LFT-VP Endo Eye® (Olympus, Tokyo, Japan).

Finally, flexible endoscopes have also been used as viewers in order to solve the deficits in vision for this type of surgery.⁵

Table 2 – Multichannel single ports and principal characteristics

Device	Incision, mm	No. of channels	Channel ≥ 12 mm	Inventoriable
TriPort®	15-20	3	Yes	–
QuadPort®	25-60	4	Yes (15 mm)	–
AirSeal®	15-20	–	Yes	–
Uni-X®	15-20	3	No	–
SILS®	15-20	3	Yes	–
X-Cone®	15-20	3	Yes	Yes
Endocone®	>20	8	Yes	Yes
SSL®	15-20	3	Yes (15 mm)	–

Table 3 – Instruments for single port surgery

Instrument	Available range	Angle	Variable length
Conventional	+++	0°	+++
Roticulator®	+	0°-80°	–
Real Hand®	+++	0°-90°	++
Laparo Angle®	+	0°-90°	++
Articulated	++	Variable	++

Instruments

The existence of a single incision for access to the abdomen allows for only minimal triangulation and creates competition for the external work space, resulting in a loss of capacity for tissue traction and ergonomics.

The use of articulated instruments of various lengths, whether curved or multi-jointed, has attempted to solve these difficulties (Table 3).

Articulated instruments to allow for greater triangulation, but although in the majority of cases they have been designed to solve the problems of lack of space and hands crossing in the external work area, their efficacy is limited. Although articulating instruments improve triangulation and distance the surgeon's hands from the workspace, they have a limited utility since they are fixed models designed for specific types of surgeries.

Clinical experience

The first study on cholecystectomy by single incision surgery was published in 1997,⁶ after gynaecologists and paediatric surgeons had developed techniques for tubal ligation, appendectomy, and hysterectomy using this type of access.⁷⁻⁹

Subsequently, a substantial amount of time passed during which no notable studies in the field were published until Cuesta et al¹⁰ in 2008 presented their experience with

“invisible cholecystectomy,” exponentially increasing the number of references to this type of procedure in recent months.¹¹⁻²² As single port cholecystectomies have risen in prominence, a number of other basic procedures such as apendectomy²³⁻²⁸ and abdominal wall surgery²⁹⁻³³ have been developed.

With respect to advanced surgical procedures, some experience has been gained in colorectal and bariatric surgery. Since 2008, right and left colectomies have been described both for benign and malignant diseases,³⁴⁻⁴⁴ with a recent publication on the first rectal resection for a benign disease.⁴⁵ Ample experience has been gained in bariatric surgery in the installation of gastric bands,⁴⁶⁻⁵⁰ and recently the first cases have been described of gastric bypasses⁵¹ and sleeves.⁵²

Lastly, anecdotal experience is available from a number of procedures such as transabdominal and retroperitoneal adrenalectomy,⁵³⁻⁵⁸ splenectomy,^{59,60} treatment of cystic lesions,^{61,62} gastrostomy^{63,64} and gastrojejunostomy.^{65,66}

In general, the majority of previously cited publications provide little scientific evidence since these are clinical cases or retrospective studies, based only on illustrating the feasibility, safety, and aesthetic benefits of the various procedures. In any case, these studies show the effort that has been put into developing this area of knowledge.

Advantages and inconveniences

From a clinical point of view, several potential (and scientifically unproven) benefits exist. Conceptually, single

incision laparoscopy could provide the advantages from NOTES but with a much lower dependence on technology, thus avoiding the problems inherent to this type of access. Therefore, this technology presents improved feasibility, accessibility, and economic costs than other recently developed techniques.^{34,62}

Furthermore, some situations exist in which this method could be especially beneficial, such as patients with concomitant umbilical hernia through which the single port could be installed, or in those that require widening of the incision for extraction of surgical equipment.

In contrast, a series of problems remain as it occurs with new technologies under development, such as the break with basic concepts for MIS practices and the adoption of new ones. Linear vision, difficulty of triangulation, different ergonomics, and the need for specific instruments are some aspects that will require work and development of standards for use.

Lastly, there is a lack of studies^{19,28} that provide evidence on the results obtained using these techniques, with a prominent void in significant statistical differences between conventional approaches and those performed using single incisions. Furthermore, we must also call attention to the potential risks of this technique that have not been researched, such as the complications inherent to the surgical wound. It is important to establish the potential problems that can arise from incisional hernias, an especially worrying complication in the context of aesthetics being one of the principal benefits. In this respect, and based on our own experience with the Safe Port Plug technique for closing trocar orifices, we have commenced a clinical trial study with the primary objective of evaluating the various types of closing the incision following single port surgery.⁶⁷

Clinical studies and the evaluation of their results

The uncontrolled dissemination of new endoscopic surgery techniques can lead to problems similar to those provoked during the first years of expansion in traditional laparoscopic surgery. Furthermore, the objective of these techniques must be concentrated on an improvement in patient care, which must not be diluted by other interests. Therefore, any novel procedure in endoscopic surgery must be evaluated from the point of view of its safety, efficacy, cost, and accessibility.⁶⁸

Recently, a procedure for evaluating surgical innovations has been proposed using the IDEAL model (idea, development, explanation, assessment, long-term study)^{69,70} This model is based on the idea that the innovation process must be developed from its inception in a continued and ordered manner, along with an evaluation process, until its definitive validation using randomized studies.⁷¹

Currently, single incision surgery is in a process of evolution that demands a unified registry for the evaluation of the safety and efficacy of its procedures. In some procedures that have a significant number of published cases with low morbidity and zero mortality, such as in the case of cholecystectomy, we would be justified in starting the validation process of this

technique with respect to other standards using prospective and randomized studies.⁷¹

Conclusions

Surgery without visible incisions and by single incision is a novel concept that has spread amongst surgeons, patients, and the equipment and instrument industries.

Single incision laparoscopic surgery can be considered an MIS tool under development, which is progressively consolidating as a bridge technology between conventional laparoscopic surgery and the most advance emergent techniques.

Although single incision laparoscopy offers clear advantages over NOTES surgery, it still cannot be considered a fully mature option, with further studies still required in order to demonstrate its potential benefits.

Furthermore, devices and instruments still need to be developed in order to guarantee a high level of reproducibility in the safety and efficacy of the procedures.

Finally, the development of tools that evaluate the safety and efficacy of this new technology is necessary, such as registries that ensure the communication of all cases performed and their results, as well as the validation of the various techniques using prospective randomized studies.

Conflict of interest

The authors affirm that they have no conflicts of interest.

REFERENCES

1. Schwaitzberg SD, Kochman ML, Hawes RH, Rattner DW. Natural orifice transluminal endoscopic surgery (NOTES): is it time for introduction to clinical practice? *Surgery*. 2009;146:841-2.
2. Gutt CN, Müller-Stich BP, Reiter MA. Success and complication parameters for laparoscopic surgery: a benchmark for natural orifice transluminal endoscopic surgery. *Endoscopy*. 2009;41:36-41.
3. Romanelli JR, Earle DB. Single-port laparoscopic surgery: an overview. *Surg Endosc*. 2009;23:1419-27.
4. Gill IS, Advincula AP, Aron M, Cadeddu J, Canes D, Curcillo PG, et al. Consensus statement of the consortium for laparoendoscopic single-site surgery. *Surg Endosc*. 2009. doi:10.1007/s00464-009-0688-8
5. Teixeira J, McGill K, Binenbaum S, Forrester G. Laparoscopic single-site surgery for placement of an adjustable gastric band: initial experience. *Surg Endosc*. 2009;23:1409-14.
6. Navarra G, Pozza E, Occhionorelli S, Carcoforo P, Donini I. One-wound laparoscopic cholecystectomy. *Br J Surg*. 1997;84:695.
7. Wheelless CR. A rapid, inexpensive and effective method of surgical sterilization by laparoscopy. *J Reprod Med*. 1969;5:255.
8. Pelosi MA, Pelosi 3rd MA. Laparoscopic supracervical hysterectomy using a single-umbilical puncture (mini-laparoscopy). *J Reprod Med*. 1992;37:777-84.
9. Esposito C. One-trocar appendectomy in pediatric surgery. *Surg Endosc*. 1998;12:177-8.

10. Cuesta MA, Berends F, Veenhof AA. The "invisible cholecystectomy": a transumbilical laparoscopic operation without a scar. *Surg Endosc.* 2008;22:1211-3.
11. Romanelli JR, Mark L, Omotosho PA. Single port laparoscopic cholecystectomy with the TriPort system: a case report. *Surg Innov.* 2008;15:223-8.
12. Chow A, Purkayastha S, Paraskeva P. Appendectomy and cholecystectomy using single-incision laparoscopic surgery (SILS): the first UK experience. *Surg Innov.* 2009;16:211-7.
13. Binenbaum SJ, Teixeira JA, Forrester GJ, Harvey EJ, Afthinos J, Kim GJ, et al. Single-incision laparoscopic cholecystectomy using a flexible endoscope. *Arch Surg.* 2009;144:734-8.
14. Kuon Lee S, You YK, Park JH, Kim HJ, Lee KK, Kim DG. Single-port transumbilical laparoscopic cholecystectomy: a preliminary study in 37 patients with gallbladder disease. *J Laparoendosc Adv Surg Tech A.* 2009;19:495-9.
15. Philipp SR, Miedema BW, Thaler K. Single-incision laparoscopic cholecystectomy using conventional instruments: early experience in comparison with the gold standard. *J Am Coll Surg.* 2009;209:632-7.
16. Ponsky TA. Single port laparoscopic cholecystectomy in adults and children: tools and techniques. *J Am Coll Surg.* 2009;209:1-6.
17. Hernandez JM, Morton CA, Ross S, Albrink M, Rosemurgy AS. Laparoendoscopic single site cholecystectomy: the first 100 patients. *Am Surg.* 2009;75:681-5.
18. Cugat Andorrà E, García-Domingo MI, Herrero Fonollosa E, Rivero Déniz J, Marco Molina C. Colectectomía laparoscópica a través de una mínima incisión única. *Cir Esp.* 2009;85:315-7.
19. Vidal O, Valentini M, Espert JJ, Ginesta C, Jimeno J, Martínez A, et al. Laparoendoscopic single-site cholecystectomy: a safe and reproducible alternative. *J Laparoendosc Adv Surg Tech A.* 2009;19:599-602.
20. Hu H, Zhu J, Wang W, Huang A. Optimized transumbilical endoscopic cholecystectomy: a randomized comparison of two procedures. *Surg Endosc.* 2009. doi:10.1007/s00464-009-0730-x
21. Hagen ME, Wagner OJ, Thompson K, Jacobsen G, Spivack A, Wong B, et al. Supra-pubic single incision cholecystectomy. *J Gastrointest Surg.* 2009. doi:10.1007/s11605-009-1079-0
22. Chow A, Purkayastha S, Aziz O, Paraskeva P. Single-incision laparoscopic surgery for cholecystectomy: an evolving technique. *Surg Endosc.* 2009. doi:10.1007/s00464-009-0655-4
23. Ateş O, Hakgüder G, Olguner M, Akgür FM. Single-port laparoscopic appendectomy conducted intracorporeally with the aid of a transabdominal sling suture. *J Pediatr Surg.* 2007;42:1071-4.
24. Vidal O, Valentini M, Ginestà C, Benarroch G, García-Valdecasas JC. Single incision laparoscopic appendectomy (SILS): initial experience. *Cir Esp.* 2009;85:317-9.
25. Hong TH, Kim HL, Lee YS, Kim JJ, Lee KH, You YK, et al. Transumbilical single-port laparoscopic appendectomy (TUSPLA): scarless intracorporeal appendectomy. *J Laparoendosc Adv Surg Tech A.* 2009;19:75-8.
26. Roberts KE. True single-port appendectomy: first experience with the "puppeteer technique". *Surg Endosc.* 2009;23:1825-30.
27. Nguyen NT, Reavis KM, Hinojosa MW, Smith BR, Stamos MJ. A single-port technique for laparoscopic extended stapled appendectomy. *Surg Innov.* 2009;16:78-81.
28. Vidal O, Valentini M, Ginestà C, Martí J, Espert JJ, Benarroch G, et al. Laparoendoscopic single-site surgery appendectomy. *Surg Endosc.* 2009. doi:10.1007/s00464-009-0661-6
29. Cugura JF, Kirac I, Kulis T, Janković J, Beslin MB. First case of single incision laparoscopic surgery for totally extraperitoneal inguinal hernia repair. *Acta Clin Croat.* 2008;47:249-52.
30. Jacob BP, Tong W, Reiner M, Vine A, Katz LB. Single incision total extraperitoneal (one SITE) laparoscopic inguinal hernia repair using a single access port device. *Hernia.* 2009;13:571-2.
31. Bucher P, Pugin F, Morel P. Single port laparoscopic repair of primary and incisional ventral hernia. *Hernia.* 2009;13:569-70.
32. Agrawal S, Shaw A, Soon Y. Single-port laparoscopic totally extraperitoneal inguinal hernia repair with the TriPort system: initial experience. *Surg Endosc.* 2009. doi:10.1007/s00464-009-0663-4
33. Sánchez López DJ, Garijo Alvarez J, García-Sancho Téllez L, Sánchez-Cabezudo Noguera F, Torres Jiménez J. Eventroplastia laparoscópica por eventración umbilical encarcerada a través de una sola incisión: un nuevo abordaje. doi:10.1016/j.ciresp.2009.10.001.
34. Bucher P, Pugin F, Morel P. Single port access laparoscopic right hemicolectomy. *Int J Colorectal Dis.* 2008;23:1013-6.
35. Remzi FH, Kirat HT, Kaouk JH, Geisler DP. Single-port laparoscopy in colorectal surgery. *Colorectal Dis.* 2008;10:823-6.
36. Leroy J, Cahill RA, Asakuma M, Dallemagne B, Marescaux J. Single-access laparoscopic sigmoidectomy as definitive surgical management of prior diverticulitis in a human patient. *Arch Surg.* 2009;144:173-9.
37. Merchant AM, Lin E. Single-incision laparoscopic right hemicolectomy for a colon mass. *Dis Colon Rectum.* 2009;52:1021-4.
38. Ostrowitz MB, Eschete D, Zemon H, DeNoto G. Robotic-assisted single-incision right colectomy: early experience. *Int J Med Robot.* 2009;5:465-70.
39. Morales-Conde S, García Moreno J, Cañete Gómez J, Barranco Moreno J, Socas Macías M. Hemicolectomía derecha por cáncer de colon por vía laparoscópica con puerto único. *Cir Esp.* 2009. doi:10.1016/j.ciresp.2009.07.016
40. Remzi FH, Kirat HT, Geisler DP. Laparoscopic single-port colectomy for sigmoid cancer. *Tech Coloproctol.* 2009. doi:10.1007/s10151-009-0545-8
41. Brunner W, Schirnhöfer J, Waldstein-Wartenberg N, Frass R, Weiss H. Single incision laparoscopic sigmoid colon resections without visible scar: a novel technique. *Colorectal Dis.* 2009. doi:10.1111/j.1463-1318.2009.01894.x
42. Law WL, Fan JK, Poon JT. Single incision laparoscopic left colectomy for carcinoma of distal transverse colon. *Colorectal Dis.* 2009. doi:10.1111/j.1463-1318.2009.02114.x
43. Rieger NA, Lam FF. Single-incision laparoscopically assisted colectomy using standard laparoscopic instrumentation. *Surg Endosc.* 2009. doi:10.1007/s00464-009-0683-0
44. Bucher P, Pugin F, Morel P. Transumbilical single incision laparoscopic sigmoidectomy for benign disease. *Colorectal Dis.* 2009. doi:10.1111/j.1463-1318.2009.01825.x
45. Geisler D, Condon ET, Remzi FH. Single incision laparoscopic total proctocolectomy with ileopouch anal anastomosis. *Colorectal Dis.* 2009. doi:10.1111/j.1463-1318.2009.02115.x
46. Nguyen NT, Hinojosa MW, Smith BR, Reavis KM. Single laparoscopic incision transabdominal (SLIT) surgery-adjustable gastric banding: a novel minimally invasive surgical approach. *Obes Surg.* 2008;18:1628-31.
47. Saber AA, El-Ghazaly TH. Early experience with single-access transumbilical adjustable laparoscopic gastric banding. *Obes Surg.* 2009;19:1442-6.
48. Oltmann SC, Rivas H, Varela E, Goova MT, Scott DJ. Single-incision laparoscopic surgery: a case report of SILS adjustable gastric banding. *Surg Obes Relat Dis.* 2009;5:362-4.
49. De la Torre RA, Satgunam S, Morales MP, Dwyer CL, Scott JS. Transumbilical single-port laparoscopic adjustable gastric

- band placement with liver suture retractor. *Obes Surg*. 2009. doi:10.1007/s11695-009-9896-5
50. Teixeira J, McGill K, Koshy N, McGinty J, Todd G. Laparoscopic single-site surgery for placement of adjustable gastric band—a series of 22 cases. *Surg Obes Relat Dis*. 2009. doi:10.1016/j.soard.2009.03.220
 51. Huang CK, Houngh JY, Chiang CJ, Chen YS, Lee PH. Single incision transumbilical laparoscopic roux-en-y gastric bypass: a first case report. *Obes Surg*. 2009. doi:10.1007/s11695-009-9900-0
 52. Reavis KM, Hinojosa MW, Smith BR, Nguyen NT. Single-laparoscopic incision transabdominal surgery sleeve gastrectomy. *Obes Surg*. 2008;18:1492-4.
 53. Castellucci SA, Curcillo PG, Ginsberg PC, Saba SC, Jaffe JS, Harmon JD. Single port access adrenalectomy. *J Endourol*. 2008;22:1573-6.
 54. Walz MK, Alesina PF. Single access retroperitoneoscopic adrenalectomy (SARA)—one step beyond in endocrine surgery. *Langenbecks Arch Surg*. 2009;394:447-50.
 55. Jeong BC, Park YH, Han DH, Kim HH. Laparoendoscopic single-site and conventional laparoscopic adrenalectomy: a matched case-control study. *J Endourol*. 2009;23:1957-60.
 56. Ryu DS, Park WJ, Oh TH. Retroperitoneal laparoendoscopic single-site surgery in urology: initial experience. *J Endourol*. 2009;23:1857-62.
 57. Sáenz Coromina A, Martí Gallostra M, Martí Ragué J. Suprarrenalectomía derecha por cirugía laparoscópica a través de un solo orificio: experiencia inicial en 2 pacientes. *Cir Esp*. 2009. doi:10.1016/j.ciresp.2009.05.015
 58. Cindolo L, Gidaro S, Tamburro FR, Schips L. Laparo-endoscopic single-site left transperitoneal adrenalectomy. *Eur Urol*. 2009. doi:10.1016/j.eururo.2009.07.001
 59. Barbaros U, Dinççağ A. Single incision laparoscopic splenectomy: the first two cases. *J Gastrointest Surg*. 2009;13:1520-3.
 60. Targarona EM, Balague C, Martinez C, Pallares L, Estalella L, Trias M. Single-port access: a feasible alternative to conventional laparoscopic splenectomy. *Surg Innov*. 2009. doi:10.1177/1553350609353765
 61. Targarona E, Balagué C, Martínez C, Pallarés L, Trías M. Fenestración laparoscópica de un quiste esplénico mediante una técnica de acceso único. *Cir Esp*. 2009. doi:10.1016/j.ciresp.2009.04.010
 62. Moreno Sanz C, Herrero Bogajo ML, Manzanera Díaz M, Pascual Pedreño A, Tadeo Ruiz G. Cirugía laparoscópica con puerto único. Ampliación del espectro de utilización. *Cir Esp*. 2009. doi:10.1016/j.ciresp.2009.03.008
 63. Karpelowsky J, Numanoglu A, Rode H. Single-port laparoscopic gastrotomy. *Eur J Pediatr Surg*. 2008;18:285-6.
 64. Podolsky ER, Rottman SJ, Curcillo PG. Single Port Access (SPA) gastrotomy tube in patients unable to receive percutaneous endoscopic gastrotomy placement. *Surg Endosc*. 2009;23:1142-5.
 65. Nguyen NT, Slone J, Reavis KM, Woolridge J, Smith BR, Chang K. Laparoscopic transumbilical gastrojejunostomy: an advanced anastomotic procedure performed through a single site. *J Laparoendosc Adv Surg Tech A*. 2009;19:199-201.
 66. Bucher P, Pugin F, Morel P. Transumbilical single-incision laparoscopic intracorporeal anastomosis for gastrojejunostomy: case report. *Surg Endosc*. 2009;23:1667-70.
 67. Moreno-Sanz C, Picazo-Yeste JS, Manzanera-Díaz M, Herrero-Bogajo ML, Cortina-Oliva J, Tadeo-Ruiz G. Prevention of trocar site hernias: description of the safe port plug technique and preliminary results. *Surg Innov*. 2008;15:100-4.
 68. Neugebauer EA, Becker M, Buess GF, Cuschieri A, Dauben HP, Fingerhut A, et al. EAES recommendations on methodology of innovation management in endoscopic surgery. *Surg Endosc*. 2010. DOI: 10.1007/s00464-009-0818-3
 69. Barkun JS, Aronson JK, Feldman LS, Maddern GJ, Strasberg SM. Evaluation and stages of surgical innovations. *Lancet*. 2009;374:1089-96.
 70. Ergina PL, Cook JA, Blazeby JM, Boutron I, Clavien PA, Reeves BC, et al. Challenges in evaluating surgical innovation. *Lancet*. 2009;374:1097-104.
 71. McCulloch P, Altman DG, Campbell WB, Flum DR, Glasziou P, Marshall JC, et al. No surgical innovation without evaluation: the IDEAL recommendations. *Lancet*. 2009;374:1105-12.