Incisional hernia prevention in obese population

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Secretary of Science, EHS Board

Hernia (2023) 27:557–563
https://doi.org/10.1007/s10029-022-02688-6

ORIGINAL ARTICLE

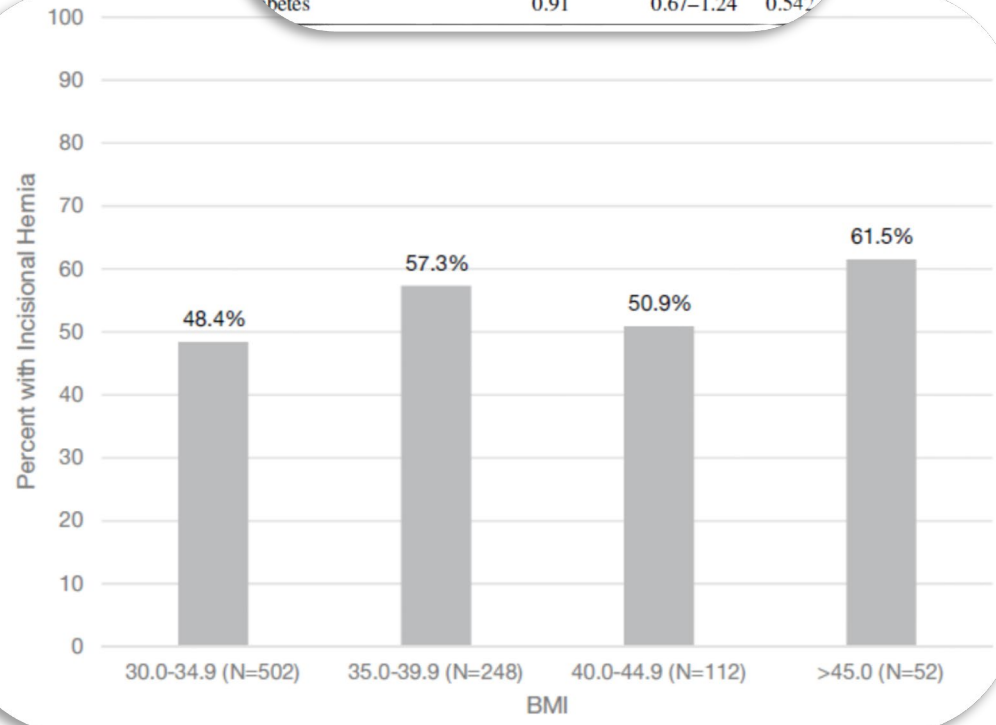
Incisional hernia rates following midline laparotomy in the obese patient: a retrospective review

C. J. Wehrle[1] · P. Shukla[2] · B. T. Miller[1] · K. E. Blake[1] · A. S. Prabhu[1] · C. C. Petro[1] · D. M. Krpata[1] · L. R. Beffa[1] · C. Tu[3] · M. J. Rosen[1]

- 2241 patients
- General, Colorectal, Gynecologic, Hepatobiliary/Surgical Oncology, and Urologic Surgery
- The median BMI for all patients was 34.3 kg/m^2(range 30.0–59.1)
- CT scan at 1 yr
- 59% incisional hernia
- 15% underwent repair

Table 4 Logistic regression model associating type of surgery, demographic information, and potential risk factors with radiographic evidence of incisional hernia

Parameter	Odds Ratio	95% CI	p
General surgery	1.09	0.74–1.61	0.669
Hepatobiliary/surgical oncology	0.42	0.25–0.70	<0.001
Gynecologic surgery	0.79	0.52–1.22	0.287
Urologic surgery	0.32	0.19–0.53	<0.001
Increasing age at surgery	0.99	0.98–1.00	0.039
Male gender	1.42	1.00–2.00	0.048
BMI	1.02	0.99–1.05	0.222
Tobacco use (never)	1.29	0.79–2.12	0.312
Tobacco use (quit)	1.40	0.84–2.33	0.194
Race (white)	0.70	0.07–6.79	0.749
Race (black)	0.73	0.07–7.26	0.780
Race (multiracial/other)	1.12	0.09–13.65	0.929
Ethnicity (hispanic)	0.60	0.14–2.62	0.499
Ethnicity (not hispanic)	4.13	2.05–9.13	<0.001
Operation for malignancy	1.04	0.75–1.45	0.797
betes	0.91	0.67–1.24	0.542



World J Surg (2022) 46:2984–2995
https://doi.org/10.1007/s00268-022-06715-6

SCIENTIFIC REVIEW

Fascial Dehiscence and Incisional Hernia Prediction Models: A Systematic Review and Meta-analysis

Amarit Tansawet[1,2] · ngsatorn[3] · Suphakarn Techapor · · Ammarin Thakkinstian[1]

IH models

- most commonly included factor
  - BMI
  - surgical approach *(laparotomy or laparoscopy)*
  - history of smoking
  - ethnicity
  - Emergency operation (**OR** *4.65; 3.90 - 5.55*)
- Level of evidence included in the score according to GRADE: *very low*

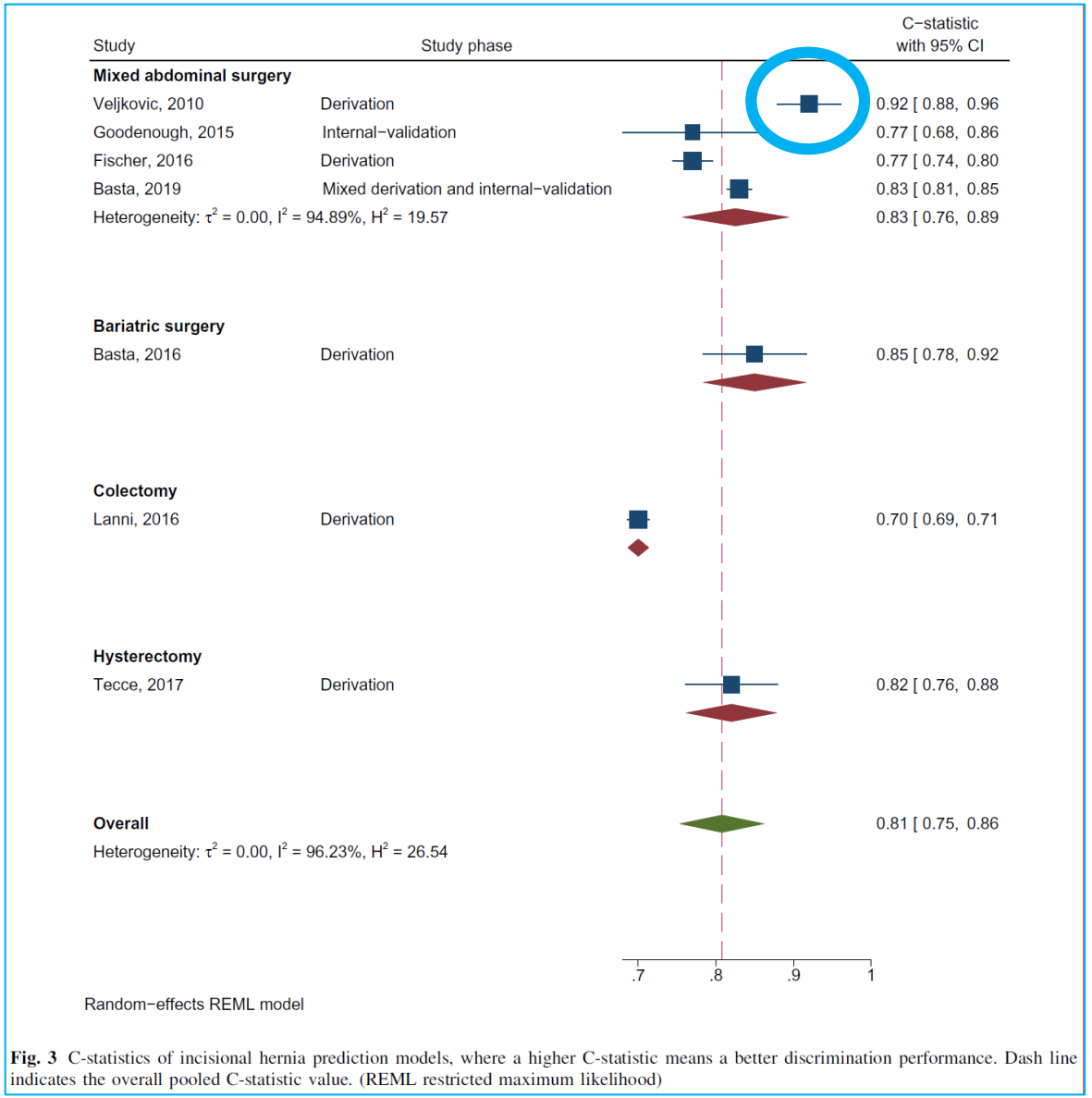


Fig. 3 C-statistics of incisional hernia prediction models, where a higher C-statistic means a better discrimination performance. Dash line indicates the overall pooled C-statistic value. (REML restricted maximum likelihood)

World J Surg (2022) 46:2984–2995

Incisional hernia occurence

Visceral Obesity, Not Elevated BMI, Is Strongly Associated With Incisional Hernia After Colorectal Surgery

Christopher T. Aquina, M.D.[1] • Aaron S. Rickles, M.D., M.P.H.[1]
Christian P. Probst, M.D.[1] • Kristin N. Kelly, M.D., M.P.H.[1] • Andrew-Paul Deeb, B.S.[1]

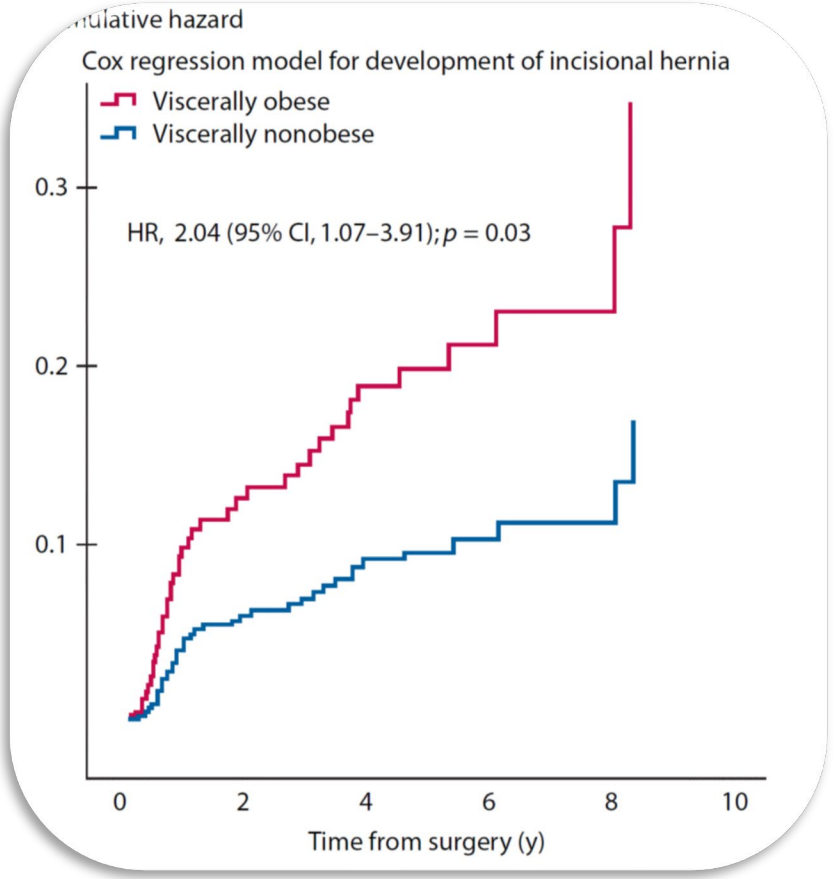
METHOD

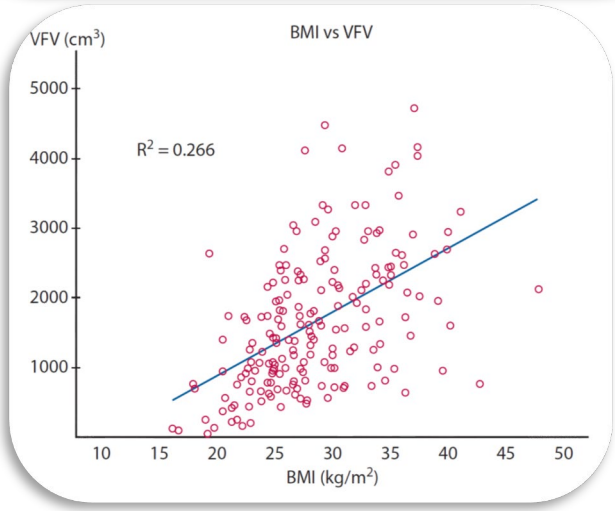
- 193 pts analyzed retrospectively (CRCA resections open and LAP)
- Preoperative CT scan – evaluation of visceral fat (cm^3)

OUTCOMES

- No strong association between visceral fat and BMI
- IH incidence positively correlates with visceral fat and total body fat
- Visceral obesity increases 4 times the risk of SSI and IH

Dis Colon Rectum 2015; 58: 220–227





costs

JOURNAL OF SURGICAL RESEARCH • NOVEMBER 2016 (206) 214–222

ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.JournalofSurgicalResearch.com

JSR Journal of Surgical Research

Association for Academic Surgery

The cost of preventable comorbidities on wound complications in open ventral hernia repair

CrossMark

*Tiffany C. Cox, MD, Laurel J. Blair, MD, Ciara R. Huntington, MD, Paul D. Colavita, MD, Tanushree Prasad, MA, Amy E. Lincourt, PhD, MBA, B. Todd Heniford, MD, FACS, and Vedra A. Augenstein, MD, FACS**

Division of Gastrointestinal and Minimally Invasive Surgery, Carolinas Laparoscopic and Advanced Surgery

500 pts submitted to open AWR (PCMs: diabetes, smoke,obesity)

scenario	No PCM	1 PCM	2+PCM
Total no complications	31.787	41.910	65.453
Total with complication	55.443	67.234	80.660
Total with SSO	55.443	62.390	75.408
Total with mesh infection	-	134.238	160.483

Risk-Assessment Score and Patient Optimization as Cost Predictors for Ventral Hernia Repair

Sherif Saleh, MS, Margaret A Plymale, DNP, Daniel L Davenport, PhD, John Scott Roth, MD,

JACS Journal of the American College of Surgeons

Weight loss	percent	Total cost
Not indicated	75.4%	19.600 $
Indicated but failed	17.2%	27.300 $
obtained	7.4%	17.200 $

factors for IH occurrence

IH are the result of inadequate early healing of the myofascial abdominal wall

IH are influenced by a combination of factors:

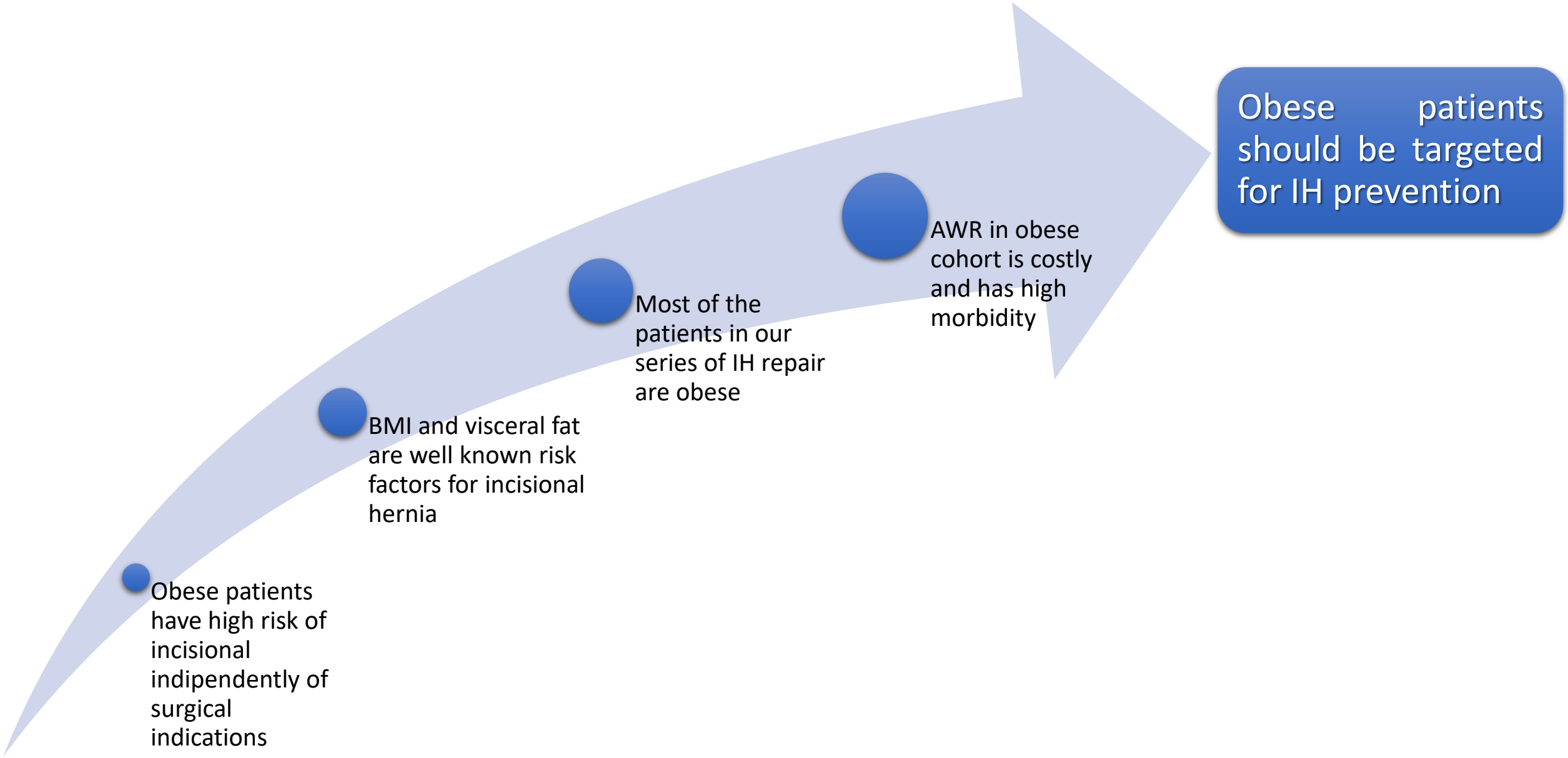
- *co-morbidities, genetics, anatomy, health-related behaviours, immunosuppressive medication, surgical technique, soft tissue healing, and SSI*.

risk varies significantly across procedures and specialties

risk factors for IH impairing wound healing:

• SSI	OR 8.55 (95%CI 1.54 - 47.5),
• diabetes	OR 6.68 (95%CI 2.02 - 22.0)
• smoking	OR 3.93 (95%CI 1.82 - 8.49)
• COPD	HR 2.35 (95%CI 1.44 - 3.83),
• obesity	HR 1.74 (95%CI 1.04 - 2.91)
• immunosuppression	OR 2.5 (95%CI 1.5 - 4.2)

Franchi M, *Obstet Gynecol* 2001;**97**:696–700
Sorensen LT, *Arch Surg* 2005;**140**:119–123
Goodenough CJ, *J Am Coll Surg* 2015;**220**:405–413
Montalti R, *Liver Transpl* 2012;**18**: 188–194


Obese patients have high risk of incisional indipendently of surgical indications
BMI and visceral fat are well known risk factors for incisional hernia
Most of the patients in our series of IH repair are obese
AWR in obese cohort is costly and has high morbidity
Obese patients should be targeted for IH prevention

Possible preventive strategies

- laparoscopic surgery
- Prevention of SSIs
- Technichal prevention
  - Type of incision
  - Type of closure
  - Mesh augmentation

laparoscopy

Obesity Surgery (2019) 29:1049–1057
https://doi.org/10.1007/s11695-018-03687-2

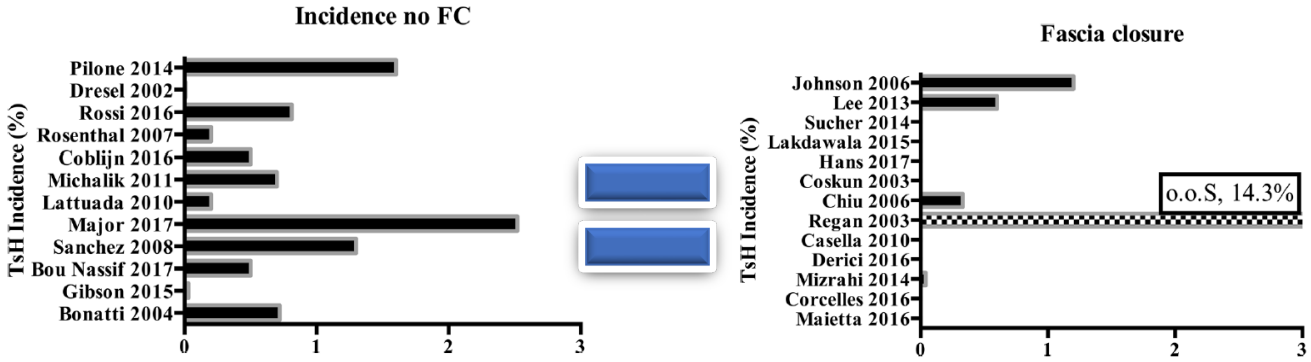
REVIEW ARTICLE

Trocar Site Hernias in Bariatric Surgery—an Underestimated Issue: a Qualitative Systematic Review and Meta-Analysis

Ioannis Karampinis[1] · Eliette Lion[1] · Maurizio Grilli[2] · Svetlana Hetjens[3] · Christel Weiss[3] · Georgi Vassilev[1] · Steffen Seyfried[1] · Mirko Otto[1,4]

Suture vs non suture

Obese patients



- 68 studies analyzed - 31.516 patients
- Various bariatric procedures

- Increasing accurracy of evaluation increases the detection rate 16.22 vs 1.37%, p = 0.06

- Increasing f-up duration increases number of incisional hernia 4.59 vs 0.8%, p = 0.023

- Increasing BMI categories increases the rate of incisional hernia 5.26 vs 0.50%, p = 0.015

fascia closure **1.13%** vs no fascia closure **0.77%**

Increasing rate of IH with increasing size of trocar access (>10mm)

Pooled incidence of TROCAR SITE HERNIA 3,2%

Surgical Endoscopy (2022) 36:4386–4391
https://doi.org/10.1007/s00464-021-08787-2

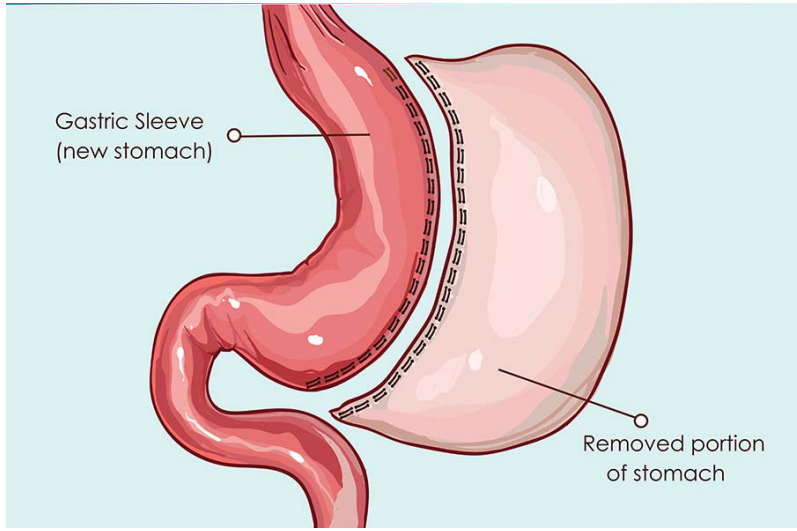
Check for updates

Trocar site hernia after gastric sleeve

Sandra Ahlqvist[1,4] · Axel Edling[2] · Magnus Alm[3] · Johan Blixt Dackhammar[1] · Pär Nordin[1] · Yücel Cengiz[1]

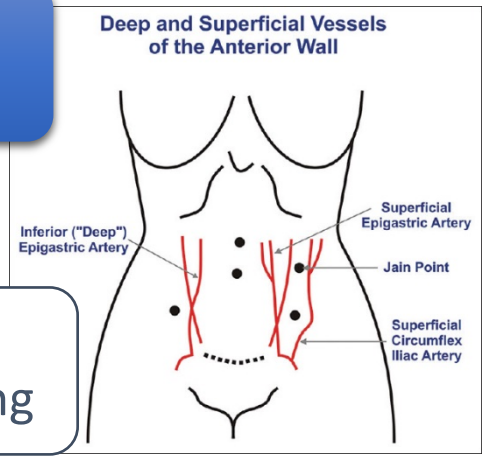
- 79 patients operated
- CT scan with abdominal ring on the trocar sites
- 37 months f-up

21,5% of patients with TSH



Entry technique

Alterantive mechanisms of IH formation



Traumatizing maneuvers when trying to stop bleeding

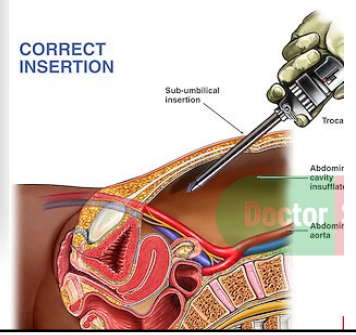
Cochrane Library

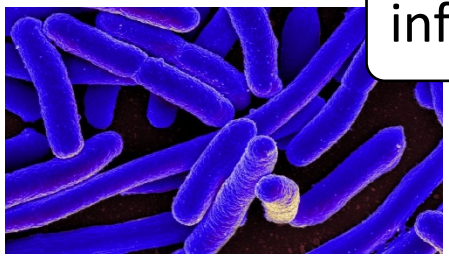
Cochrane Database of Systematic Reviews

Cochrane Database Syst Rev. 2019 Jan 18;1(1):CD006583

Laparoscopic entry techniques (Review)

Ahmad G, Baker J, Finnerty J, Phillips K, Watson A

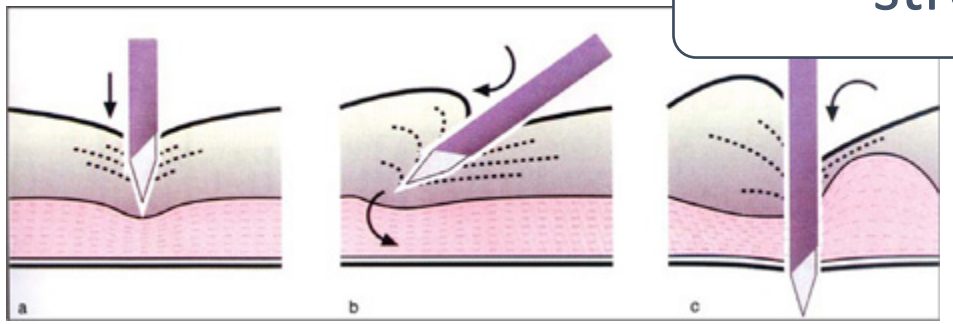




infection

Angle of entry

- No difference among techniques (open, Verres, direct trocar) of induction of pneumoperitoneum concerning primary and secondary outcomes
- Sparse number
- Insufficient quality of evidence



stretching

Surgical Endoscopy (2020) 34:5250–5258
https://doi.org/10.1007/s00464-020-07826-8

REVIEW ARTICLE

Does closure of fascia, type, and location of trocar influence occurrence of port site hernias? A literature review

Monica Gutierrez[1,2] · Mallory Stuparich[1] · Sadikah Behbehani[1] · Samar Nahas[1]

Neglectable risk for 5mm

Table 2 Hernia incidence rates by open vs. closed fascia and trocar size

	Open		Closed		*P* value	Articles
	Number of ports	Hernia incidence (%)	Number of ports	Hernia incidence (%)		
5-mm	41,406	0.08453	100	0	1	
10-mm	3579	0.19559	11,151	0.14348	.634	

No difference in fascial closure vs non closure

Table 3 Hernia incidence rates when fascia is left open by bladed vs. non-bladed trocar

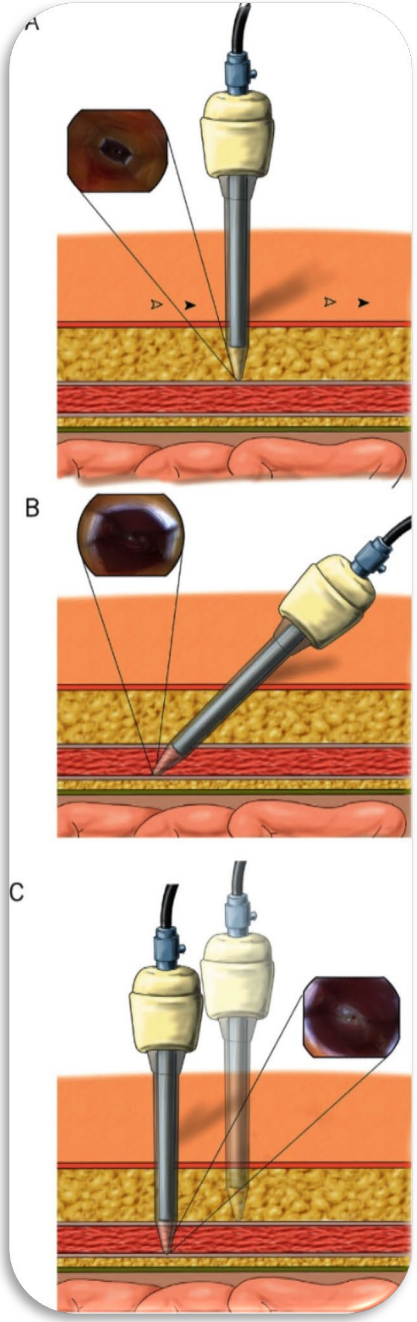
	Bladed		Non-bladed		*P* value	Articles
	Number of ports	Hernia Incidence (%)	Number of ports	Hernia Incidence (%)		
5-mm	4632	0.518	8762	0.274	.04	Ro… F…
10-mm	2795	0.396	249	0	.001	Jol… E…
12-mm	710	1.549	8304	0.120	< .001	Ro… Pilone, Rossi

Higher IH rate for bladed trocars

Port Location	# of ports	TSH %	Articles
Midline			
Umbilical	1558	1.19	Erdas, Lee, Clark, Pilone
Supraumbilical	1710	0.62	Johnson, Kang
Infra-umbilical	1172	0.94	Chatzimavroud
Periumbilical	547	0.62	Diez-Barroso
Extraumbilical	1821		
Subxiphoid	313		
Only reported as midline	538		
Total	7659		
Off-midline			
Mesogastrium	552	1.10	Pilone
Hypochondrium	542	0.40	Pilone
Only reported as off-midline	9429	0.22	Moran, Clark, Rossi, Ece
Total	10,523	0.28	

Midline trocar hernia are at higher risk

- 18,533 from 19 papers
- mean follow-up period of 22.50 ± 1.76 months
- overall trocar site hernia rate was 0.104%
- Heterogeneity 29%



Ann R Coll Surg Engl. 2016 May;98(5):340-1. doi: 10.1308/rcsann.2016.0114.

Z-entry technique reduces the risk of trocar-site hernias in obese patients

C Cisano [1], P Sapienza [1], D Crocetti [1], G de Toma [1]

Affiliations + expand

PMID: 27087329 PMCID: PMC5227034 DOI: 10.1308/rcsann.2016.0114

Free PMC article

The distance between two openings in the muscular fascia reduces the risk of trocar-site hernias because of the angled path through the abdominal wall.

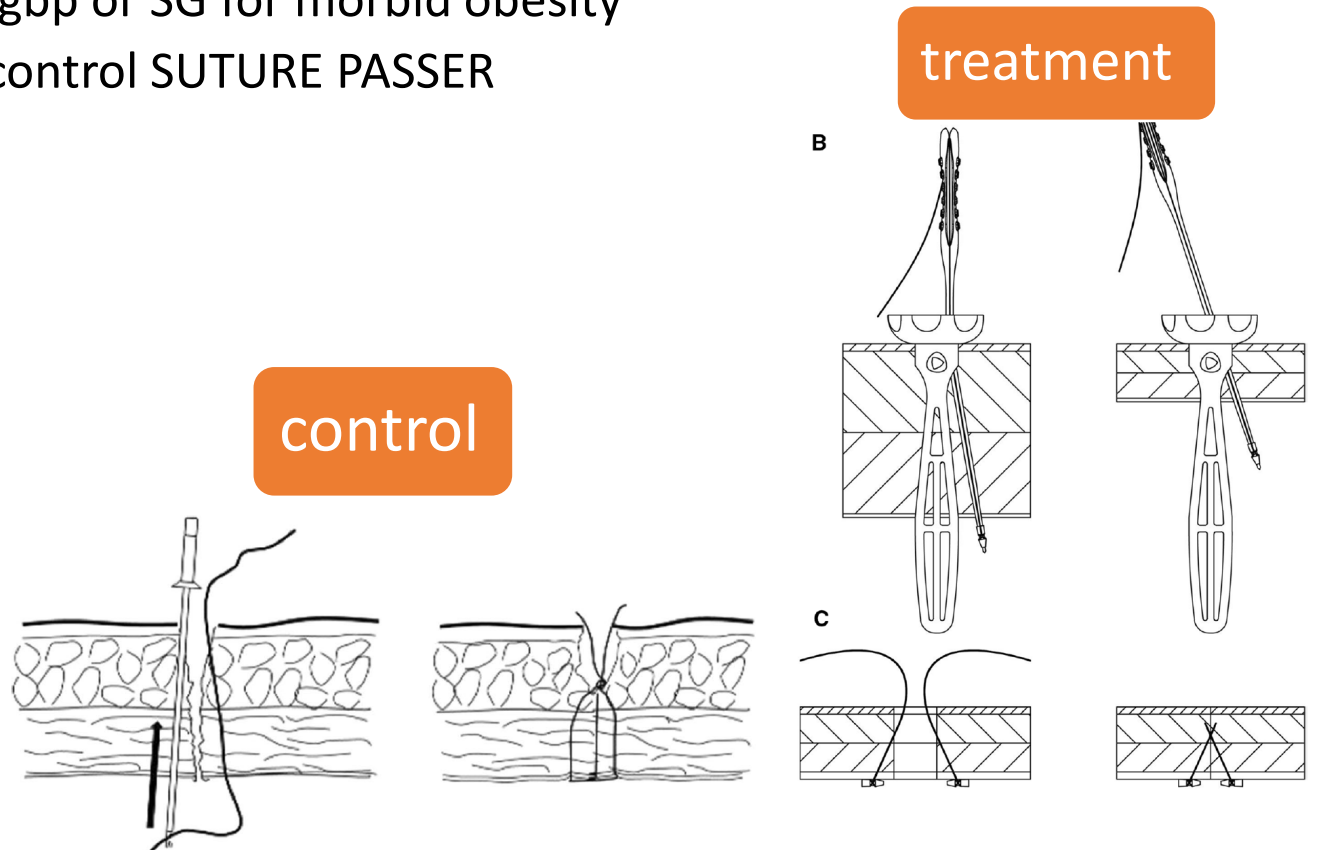
Surgical Endoscopy (2020) 34:1270–1276
https://doi.org/10.1007/s00464-019-06891-y

Trocar site closure with a novel anchor-based (neoClose®) system versus standard suture closure: a prospective randomized controlled trial

Pouya Iranmanesh[1] · Angielyn R. Rivera[1] · Kulvinder S. Bajwa[1] · Mustafa Alibhai[2,3] · Brad E. Snyder[1] · Todd D. Wilson[1] · Melissa M. Felinski[1] · Sheilendra S. Mehta[4] · Kavita D. Chandwani[1] · Connie L. Klein[1] ·

- RCT – double blinded
- Population: obese patients undergoing Rygbp or SG for morbid obesity
- 35 patients treatment NEOCLOSE, 35 pts control SUTURE PASSER
- F-up with US

	neoclose	control
Primary outcomes		
Closure time	20,2’	30,0’
Pain 1week	0,3(SD 0,8)	0,9 (SD 1,4)
Secondary outcome		
Incisional hernia 1 yr	0	0



Prophylactic Mesh vs Suture in the Closure of the Umbilical Trocar Site after Laparoscopic Cholecystectomy in High-Risk Patients for Incisional Hernia. A Randomized Clinical Trial

RCT

Laura Armañanzas, MD, Jaime Ruiz-Tovar, MD, PhD, Antonio Arroyo, MD, PhD, Pedro García-Peche, MD, Ernesto Armañanzas, MD, PhD, María Diez, MD, Isabel Galindo, MD, Rafael Calpena, MD, PhD

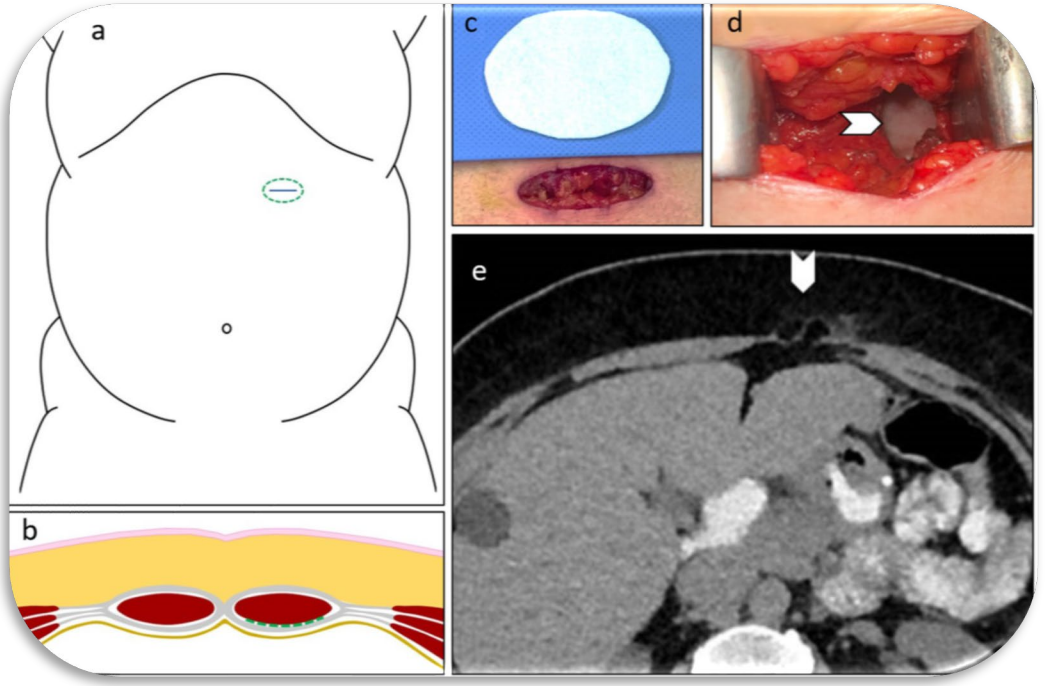
- **47** Group A (*suture non-abs*) vs **45** Group B *(intraperitoneal mesh – V patch)*
- High risk patients for TSH
  - age 65 years and older, diabetes mellitus, chronic pulmonary disease, and obesity (ie, body mass index 30 kg/m2)
- Visit early postoperative; 1-6-12 months

	Group A (suture)	Group B (mesh)	OR (95%CI)
TSH	31,9%	4.4%	10.1; (2.15 - 47.6)
Wound Infection rate	8,5%	0%	2.04; (1.7-2.5)
VAS	3 (1-6)	2 (0-6)	
Complications	similar	similar	
Operative time	71,4±25,2	69,2±26,7	
LOS	2 (1-5)	2 (1-11)	

Surgical Endoscopy (2022) 36:7225–7232
https://doi.org/10.1007/s00464-022-09088-y

Prevention of incisional hernia after single-port sleeve gastrectomy (PRISM): a prospective non-randomized controlled study

Hadrien Tranchart[1,4] · Martin Gaillard[1,4] · Sarah Bekkhoucha[1,4] · Carmelisa Dammaro[1,4] · Naim Schoucair[1,4] · Panagiotis Lainas[1,4] · Cosmin Sebastian Voican[2,4] · Pierre Chague[3,4,5] · Laurence Rocher[3,4,5] · Ibrahim Dagher[1,4]



Sample size

- 255 consecutive patients undergoing LAP SG

Inclusion criteria

- BMI >45 kg/m2

3 groups of closure

- suture without mesh
- suture with permanent mesh placement
- suture with absorbable mesh placement

Primary outcome

- Radiological IH rate 1year postoperatively

IH rates

• Suture	20%
• Reabsorbable mesh	7.1%
• Permanent mesh	5.1%

Factor	Odd ratio	95%IC	*P*
Male	8.695	[0.831–5.464]	0.115
Tobacco use	2.985	[0.118–2.066]	0.335
Absence of mesh placement	3.802	[1.633–8.849]	0.002

SSI - prevention

BJOG An International Journal of Obstetrics and Gynaecology
Royal College of Obstetricians & Gynaecologists
DOI: 10.1111/1471-0528.16963
www.bjog.org
Systematic Review

Effect of negative-pressure wound therapy on wound complications in obese women after caesarean birth: a systematic review and meta-analysis

- 10 RCTs - 5583 patients
- Obese women after cesarean section
- Intervention PICO or Prevena
- Comparison standard wound dressing
- Duration of tratment 3-7 days

LOWER
- Surgical site infections

HIGHER
- blistering

Outcomes	No. of participants (studies) Follow up	Relative effect (95% CI)	Anticipated absolute effects*		Certainty of the evidence (GRADE)
			Risk with Standard dressing	Risk difference with Negative pressure wound therapy (NPWT)	
Surgical site infection (SSI) follow up: 30 days	5529 (9 RCTs)	RR 0.79 (0.65–0.95)	83 per 1000	17 fewer per 1000 (29 fewer to 4 fewer)	⊕⊕⊕◯ MODERATE[a]
Wound complications follow up: 30 days	3438 (5 RCTs)	RR 0.99 (0.81–1.21)	87 per 1000	1 fewer per 1000 (16 fewer to 18 more)	⊕⊕◯◯ LOW[a,b]
Dehiscence follow up: 30 days	5442 (8 RCTs)	RR 1.01 (0.84–1.22)	75 per 1000	1 more per 1000 (12 fewer to 16 more)	⊕⊕◯◯ LOW[a,b]
Seroma follow up: 30 days	4006 (5 RCTs)	RR 0.96 (0.63–1.47)	21 per 1000	1 fewer per 1000 (8 fewer to 10 more)	⊕⊕⊕◯ MODERATE[b]
Haematoma follow up: 30 days	3924 (4 RCTs)	RR 0.95 (0.47–1.89)	9 per 1000	0 fewer per 1000 (5 fewer to 8 more)	⊕⊕◯◯ LOW[a,b,c]
Bleeding follow up: 30 days	3730(3 RCTs)	RR 1.78 (0.33–9.65)	9 per 1000	7 more per 1000 (6 fewer to 79 more)	⊕⊕◯◯ LOW[a,b]
Reoperation follow up: 30 days	2838 (5 RCTs)	RR 1.04 (0.58–1.87)	17 per 1000	1 more per 1000 (7 fewer to 15 more)	⊕⊕◯◯ LOW[a,b]
Readmission follow up: 30 days	4332 (5 RCTs)	RR 1.43 (0.89–2.31)	13 per 1000	6 more per 1000 (1 fewer to 17 more)	⊕◯◯◯ VERY LOW[a,b]
Blistering follow up: 30 days	3913 (5 RCTs)	RR 4.13 (1.53–11.18)	14 per 1000	43 more per 1000 (7 more to 141 more)	⊕◯◯◯ VERY LOW[a,b]

Gillespie BM, BJOG. 2022 Jan;129(2):196-207.

Laparotomy closure – current strategy

- Small bites
- Primary mesh augmentation

ORIGINAL ARTICLE

Effect of Stitch Length on Wound Complications After Closure of Midline Incisions

A Randomized Controlled Trial *Arch Surg. 2009;144(11):1056-1059*

Daniel Millbourn, MD; Yucel Cengiz, MD, PhD; Leif A. Israelsson, MD, PhD

	Long Stitch (381s)	Small Stitch (356s)	p
Suturing time	min 14 (range 13-15)	min 18 (range 17-19)	<0,001
SSI	*10,2%*	*5,2%*	0,02
IH 1yr	*18,0%*	*5,6%*	<0,001

Small bites versus large bites for closure of abdominal midline incisions (STITCH): a double-blind, multicentre, randomised controlled trial *Lancet. 2015 Sep 26;386:1254*

Eva B Deerenberg, Joris J Harlaar*, Ewout W Steyerberg, Harold E Lont, Helena C van Doorn, Joos Heisterkamp, Bas PL Wijnhoven, Willem R Schouten, Huib A Cense, Hein BAC Stockmann, Frits J Berends, F Paul HLJ Dijkhuizen, Roy S Dwarkasing, An P Jairam, Gabrielle H van Ramshorst, Gert-Jan Kleinrensink, Johannes Jeekel, Johan F Lange*

	Long Stitch (277s)	Small Stitch (268s)	p
IH 1yr	21%	13%	0,0131

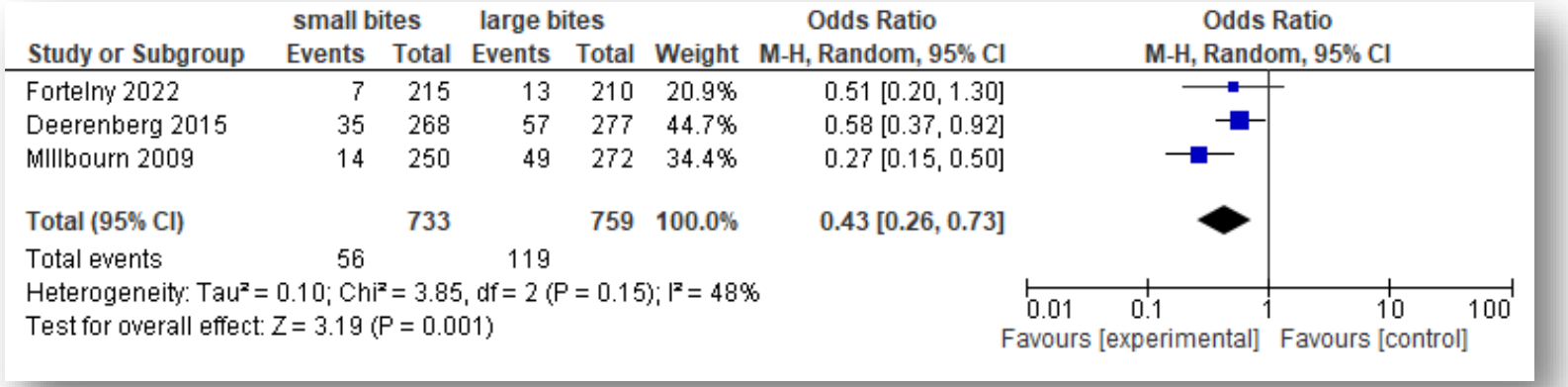
OXFORD

BJS, 2022, **109**, 839–84.
https://doi.org/10.1093/bjs/znac194
Advance Access Publication Date: 16 June 2022
Randomized Clinical Trial

Effects of the short stitch technique for midline abdominal closure on incisional hernia (ESTOIH): randomized clinical trial

René H. Fortelny[1,2,*], Dorian Andrade[3], Malte Schirren[3], Petra Baumann[4], Stefan Riedl[5], Claudia Reisensohn[5], Jan Ludolf Kewer[6], Jessica Hoelderle[6], Andreas Shamiyeh[7], Bettina Klugsberger[7], Theo David Maier[8], Guido Schumacher[9], Ferdinand Köckerling[10], Ursula Pession[11], Anna Hofmann[1] and Markus Albertsmeier[3]

	Long Stitch (210s)	Small Stitch (215s)	p
burst abdomen	*4,76%*	*1,4%*	0,05
IH 1yr	6,4%	3,3%	NS



Adding ESTOIH trial the results in Meta analisis do not change

the technique can be still recommeded

No study comparing small bites vs large bites directly in obese population

Obese patients in major trial are mixed, no definitive recommendation can be done

obese patients are a high risk category, probably small bites could be suboptimal

Hernia
https://doi.org/10.1007/s10029-022-02660-4

REVIEW

Prophylactic mesh reinforcement for midline incisional hernia prevention: systematic review and updated meta-analysis of randomized controlled trials

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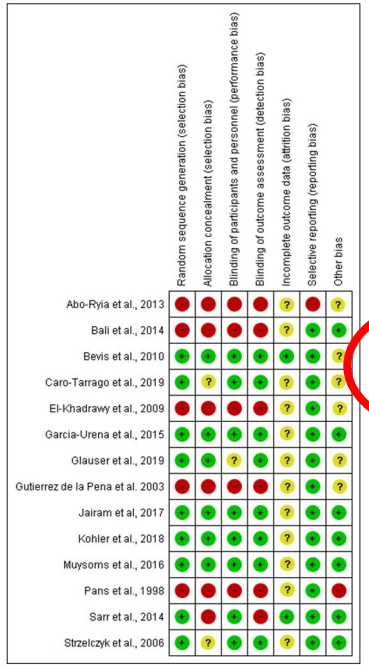
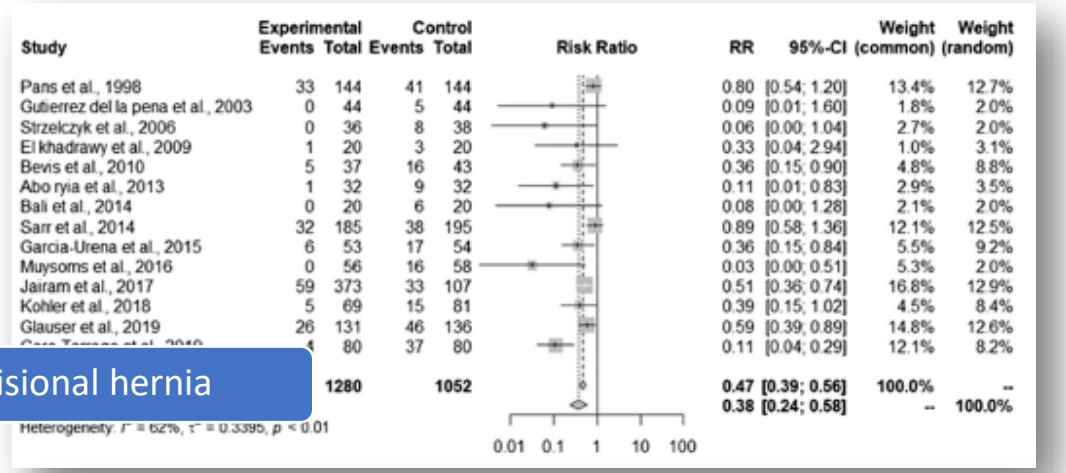
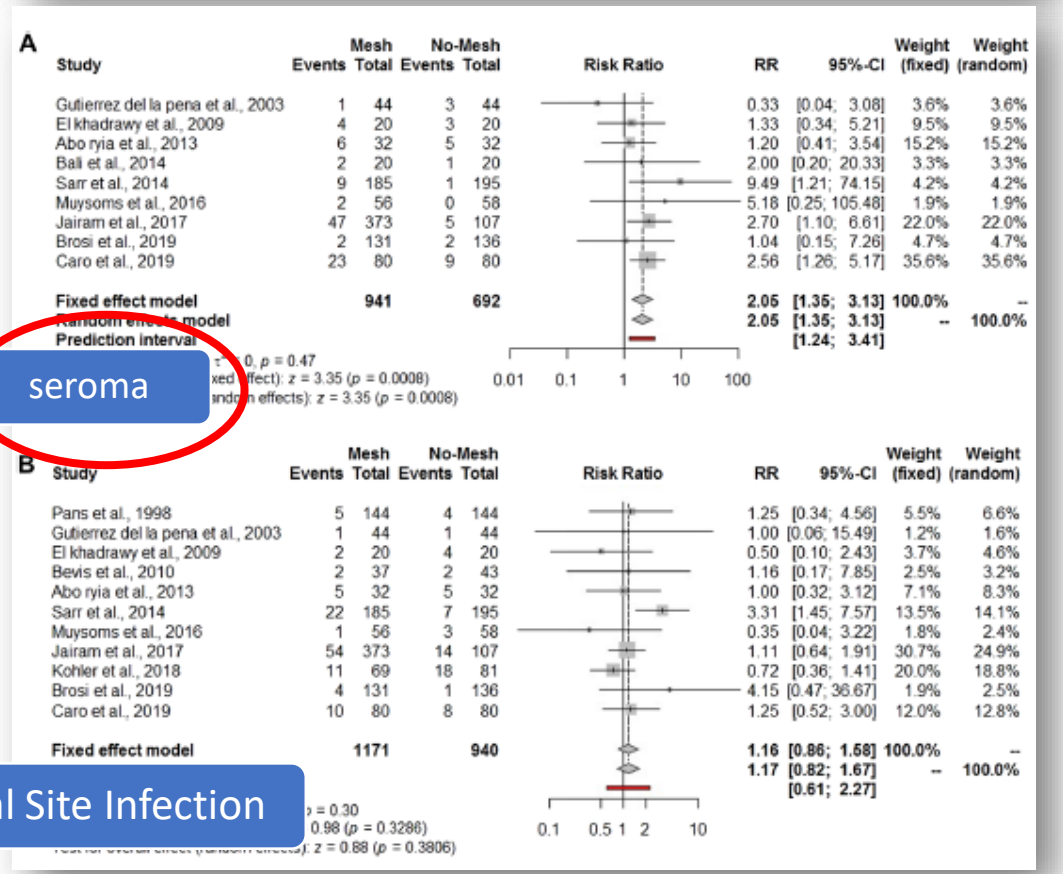
- 2332 patients included
- 1280 (54.9%) underwent PMR vs 1052 (45.1%) PSC.
- BMI 23.5 to 51 kg/m^2
- 52.9% females

- High heterogeneity:
  - Mesh position
  - Suture technique
  - Mesh material
  - F-up





Incisional hernia



seroma

Surgical Site Infection

Small bites

- Effective in reducing incisional hernia rate in low risk patients

Primary mesh augmentation

- Effective in reducing incisional hernia rate in higher risk patients

in the obese population?

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REVIEW

The effect of prophylactic mesh implantation on the development of incisional hernias in patients with elevated BMI: a systematic review and meta-analysis

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Study	Study type	n (PS/PMR)	FU (months)	FU-method	BMI (mean/SD)/(PS/PMR)	Suture technique	Mesh technique/type	Indication
Abo-Ryia 2013	RCT	32/32	48	PE, US	51.4 (10.5)/52.2 (9.1)	Continuous, non-absorbable	Preperitoneal/Polypropylene	Bariatric surgery
Jairam 2017	RCT	70/260	24	PE, US, CT	31.5 (3.5)/32.4 (5.1)	Continuous, slowly absorbable	Onlay or sublay/Lightweight polypropylene	General surgery
Pans 1998	RCT	144/144	30	PE	43.7 (0.6)/43.8 (0.5)	Interrupted, absorbable	Intraperitoneal/Polyglactin	Bariatric surgery
Sarr 2014	RCT	195/185	24	PE and/or imaging	48.2 (7.7)/48.2 (8.2)	Continuous, non-absorbable, slowly absorbable	Sublay/Biopros-thesis	Bariatric surgery
Strzelczyk 2006	RCT	38/36	28	PE, US	46.8 (7.6)/46.2 (7.1)	Continuous, non-absorbable	Sublay/Polypropylene	Bariatric surgery

PS primary suture, *PMR* primary mesh reinforcement, *RCT* randomised controlled trial, *PE* physical examination, *US* ultrasonography, *CT* computed tomography, *SD* standard deviation, *FU* follow-up

	Randomisation process	Deviations from intended interventions	Missing outcome data	Measurement of outcome	Selection of the reported result	Overall
Abo-Riya 2013	!	!	+	−	+	−
Jairam 2017	+	+	+	+	+	+
Pans 1998	!	!	+	−	+	−
Sarr 2014	+	+	+	−	+	−
Strzelczyk 2006	+	+	+	+	+	+

Low risk (+), some concern (!), high risk (−)

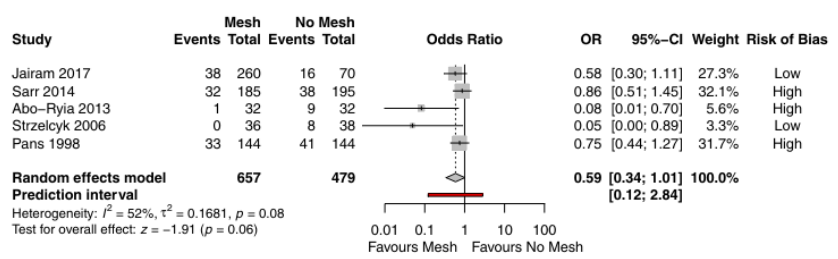
Outcomes

- Effectiveness of Profilactic Mesh implantation
- Safety of Profilactic Mesh Implantation
- Lenght of Stay

- Heterogeneity in populations
- Heterogeneity in sutures
- Heterogeneity in mesh position and type

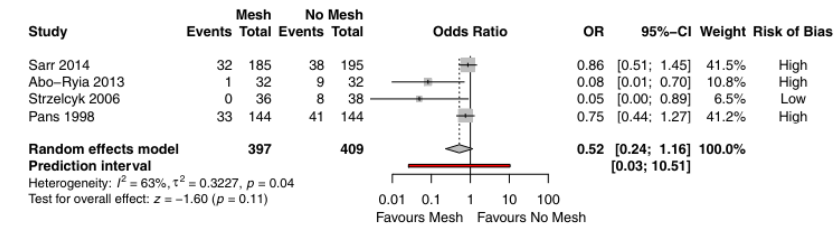
	Mesh	Suture	p
IH incidence	14%	23%	NS
Seroma	6%	4%	NS
SSI	8%	5%	NS
Lenght of Stay	10 days	11 days	NS

Incisional Hernia



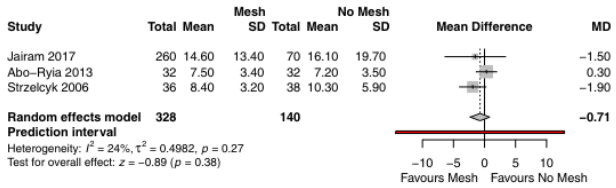
GRADE System – Certainty of Evidence: LOW

Incisional hernia in cohort with high BMI



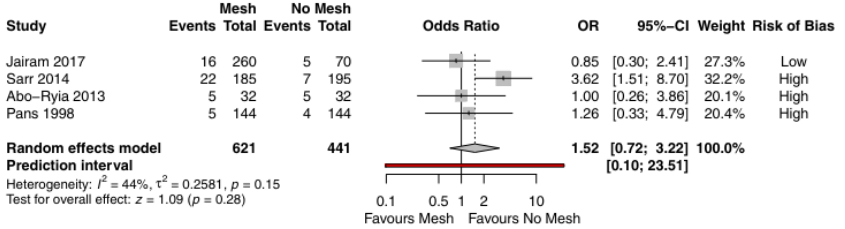
GRADE System – Certainty of Evidence: LOW

Length of hospital stay



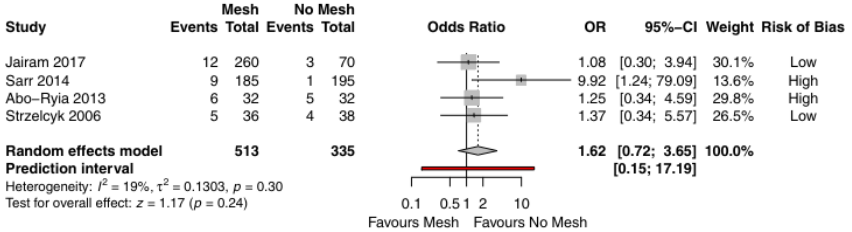
GRADE System – Certainty of Evidence: MODERATE

Surgical Site Infection



GRADE System – Certainty of Evidence: MODERATE

Seroma



GRADE System – Certainty of Evidence: LOW

Prophylactic mesh placement for prevention of incisional hernia after open bariatric surgery: a systematic review and meta-analysis

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Study	Years	Design	Study size (n)	Operation type*	Risk of bias[15]
Abo-Ryia et al	2015	RCT	64	RYGB, VBG, VSG	Low
Curro et al	2011	PNT	95	BPD	N/A
Llaguna et al	2011	PNT	134	RYGB	N/A
Pans et al	1998	RCT	288	VBG	High
Sarr et al	2014	RCT	380	RYGB	Low
Strzelczyk et al	2002	PNT	60	RYGB	N/A
Strzelczyk et al	2006	RCT	74	RYGB	High

BPD = biliopancreatic diversion; N/A = not applicable; PNT = prospective non-randomized trial; RCT = randomized control trial; RYGB = Roux-en-Y gastric bypass; VBG = vertical banded gastroplasty; VSG = vertical sleeve gastrectomy.
*All included studies comprised open bariatric surgeries only.

7 studies (4 RCTs)
1,067 patients,
498 (46.7%) prophylactic mesh

	IH	SSIs
overall	0,30 (0,13-0,68)	1,86 (0,64 – 5,40)
RCT subset	0,52 (0,24 – 1,16)	2,05 (0,59 – 7,14)

Study	Mesh type	Mesh size	Mesh position	Mesh, n	Standard closure, n	Standard closure method	Follow-up, mo*
Abo-Ryia et al	Polypropylene	10–12 cm wide, overlapping length by 4–5 cm	Preperitoneal	32	32	#1 Polyprolene continuous suture	48
Curro et al	Polypropylene	Overlapping width by 10 cm and length by 8 cm	Retromuscular	45	50	Interrupted#1 polyglactin suture	6 (3–24)†
Llaguna et al	Non-cross-linked acellular human dermal matrix	6 × 16 cm^2	Subfascial	44	62	#1 Polidioxanone continuous suture	17.3 ± 8.5
Pans et al	Polyglactin	21.5 × 26.5 cm^2	Intraperitoneal	144	144	Not reported	29.8 (0–67)
Sarr et al	Porcine small intestine sub-mucosal matrix	8-cm wide, overlapping length by 2 cm	Sublay to posterior rectus sheath	185	195	Continuous 0,#1 or #2 polypropylene, nylon, or polidioxanone suture	1.5 (1.5–48)*
Strzelczyk et al[12]	Polypropylene	8-cm wide, overlapping length by 2 cm	Onlay to anterior rectus sheath	12	48	#1 Polidioxanone continuous suture	12
Strzelczyk et al[16]	Polypropylene	8-cm wide, overlapping length by 2 cm	Retromuscular	36	38	#2 Polidioxanone continuous suture	6 (6–38)*

*Reported as mean ± standard deviation or mean (range), unless otherwise specified.
†Reported as minimum (range).

conclusions

- Obesity is a know higher risk factor for incisional hernia occurrence
- Incisional hernia repair has major costs and complications
- A specific preventive strategy for incisional hernia should implement
  - Higher use of laparoscopy and mesh augmentation for higher risk trocar accesses (midline, SILS)
  - Strict control over SSIs
  - Mesh implantation in a shared decision making with patients