B BRAUN
SHARING EXPERTISE

ESTOIH STUDY* SUMMARY

ESTOIH[1-4] study examined the impact of the short-stitch technique for midline abdominal closure on the incidence of incisional hernia(IH). The study compared the short-stich technique against the standard loop closure using Monomax®.

* ESTOIH
Effects of the short stitch technique for midline abdominal closure on incisional hernia randomized clinical trial.

Table 1. Incisional hernia rate 1 year follow up

Technique	IH rate – 1 years follow up[2]	p-value
Long stitch	3.3 % (7/210)	0.173
Short stitch	6.4 % (13/204)	

p<0.05; statistically significant difference

Table 2. Incisional hernia rate 3 years follow up

Technique	IH rate – 3 years follow up[3]	p-value
Long stitch	10.45 % (21/201)	0.136
Short stitch	7.58 % (15/198)	

p<0.05; statistically significant difference

Table 3. Incisional hernia rate 5 years follow up

Technique	IH rate – 5 years follow up[6]	p-value
Long stitch	13.90 % (26/187)	0.155
Short stitch	9.14 % (16/175)	

p<0.05; statistically significant difference

"Although the IH rate increases over time, within each period, short-stitch technique consistently exhibits a lower IH rates than long-stitch technique. This indicates that short-stitch technique is a superior option for abdominal wall closure."

Effects of the Short-Stitch Technique for Midline Abdominal Closure on Incisional Hernia. Results from the Randomised-Controlled ESTOIH Trial[1-3]

The short-stitch technique for fascial closure after midline laparotomy has been shown to reduce the incidence of incisional hernias one year postoperatively compared to the traditional large-bite technique. However, most studies evaluating this approach have been limited to a one-year follow-up period.[1,4,5]

Initiated in 2013, ESTOIH trial is the only randomized controlled study to include both 3-year and 5-year follow-up data.

Rationale

Continuous suture technique with a suture to wound length ratio of at least 4:1, using a very long-term absorbable monofilament suture material, is recommended for primary median laparotomy closure. In this sense, ESTOIH trial addresses the comparison of Short vs Long-Stitch technique using Monomax® to investigate the effects of the short-stitch technique on hernia development, compared to traditional loop closure of midline laparotomy.

Monomax® is a synthetic, absorbable, monofilament surgical suture dyed violet which intended purpose is soft tissue approximation in abdominal fascial closure. Monomax® is produced from poly (4-hydroxybutyrate) polymer.

Monomax® is indicated in cases when extended soft tissue wound support of more than 3 months is desirable in abdominal fascial closure.

Table 4. ESTOIH study design data

9 centres in Germany and Austria

30 days, 1 year, 3 years and 5 years

425 patients

Elective primary laparotomy with an incision ≥ 15 cm

Parameter	Long stitch (n=215)	Short stitch (n=210)
Suture Material	Monomax® 1, 150 cm loop, HR48	Monomax® 2/0, 150 cm, HR26
Stitch interval	10 mm	5 mm
Median wound to stitch site distance	10 mm	5 - 8 mm
Suture / wound length ratio	4:1	≥5:1
Knots (recommended)	At least 6 knots at the end of the suture line.	A self-locking knot at the begining and at the end of the suture line.

Monomax® may have contributed to low IH rates:

- The increased elasticity might help to reduce the occurrence of button-hole hernia at the wound edges[2] and reduces tension on the fascia[3].
- The delayed resorbability of the suture material is thought to support scar formation and wound healing over time, leading to fewer delayed hernias[3].
- In summary, Monomax® suture material seems to support the healing of the fascia by its high elasticity, high basic strength retention and long-lasting resorption time[2].

Table 5. Reported rates of incisional hernia and surgical site infection (SSI) in the literature

STUDY	IH rate – 1 year Follow up			SSI rate 30 days Flow Up		
	Long Stitch	Short Stitch	p-value	Long Stitch	Short Stitch	p-value
MILLBOURN[4]	18 %	5.6 %	<0.001*	10.5 %	5.2 %	0.02*
STITCH[5]	21 %	13 %	0.022*	24 %	21 %	0.419
ESTOIH[2]	6.4 %	3.3 %	0.173	Sup**: 5.24 % Deep: 0.48 % Total: 3.72 %	Sup**: 3.26 % Deep: 0.47 % Total: 5.71 %	Sup**: 0.34 Deep: 1.0

*p<0.05; statistically significant difference; **Sup: superficial

The low IH rate in the ESTOIH study stands out with previously published data. The SSI rate was remarkably low as well across treatment groups compared to the MILBOURN[4] and STITCH[5] studies.

ESTOIH study did not find direct correlation between wound infections and the occurrence of IH. Interestingly, STITCH study had yielded higher SSI rates than MILBOURN and STITCH studies despite using Triclosan-coated suture material (PDS II Plus®).

Key Notes

- **ESTOIH study reported low complication rates** at short and long-term SSI and IH rate either in short and long stitch group compared with previous literature.[1,2]
- These low complication rates can be attributed to the use of **Monomax®**.[1,2]
- **Monomax® in combination with short stitches** seems to be the best option to reduce IH rates.[2,3]
- ESTOIH study shows for the first time that using **Monomax® helps to reduce the rate of IH and other complications** despite using traditional long stitch technique.[2,3]
- **After 5 years, IH incidence stays lower in the short-stitch group** compared with the long-stitch group.[6]

CONCLUSIONS

1-, 3- and 5-years results of ESTOIH study suggest that the short-stitch technique, particularly when combined with Monomax, offers significant advantages in terms of both clinical outcomes and patient-reported quality of life.

1. Albertsmeier M, Hofmann A, Baumann P, Riedl S, Reisensohn C, Kewer JL et al. Effects of the short-stitch technique for midline abdominal closure: short-term results from the randomised-controlled ESTOIH trial. Hernia. 2022 Feb;26(1):87-95.
2. Fortelny RH, Andrade D, Schirren M, Baumann P, Riedl S, Reisensohn C et al. Effects of the short stitch technique for midline abdominal closure on incisional hernia (ESTOIH): randomized clinical trial. Br J Surg. 2022 Aug;109(9):839-845.
3. Fortelny RH, Hofmann A, Baumann P, Riedl S, Kewer JL, Hoelderle J, et al. Three-year follow-up analysis of the short-stitch versus long-stitch technique for elective midline abdominal closure randomized-controlled (ESTOIH) trial. Hernia. 2024; 28(4):1283-1291.
4. Millbourn D, Cengiz Y, Israelsson LA. Effect of stitch length on wound complications after closure of midline incisions: a randomized controlled trial. Arch Surg 2009;144(11):1056-1059.
5. Deerenberg EB, Harlaar JJ, Steyerberg EW, Lont HE, van Doorn HC, Heisterkamp J et al. Small bites versus large bites for closure of abdominal midline incisions (STITCH): a double-blind, multicentre, randomized controlled trial. Lancet 2015;386(10000):1254-1260.
6. Fortelny RH, Baumann P, Hofmann A, Riedl S, Kewer JL, Hoelderle J, et al. 5-year clinical outcome of the ESTOIH trial comparing the short-bite versus large-bite technique for elective midline abdominal closure. Hernia. 2025;29:263.

B. Braun Surgical, S.A. | Carretera de Terrassa, 121 | 08191 Rubí | Spain
Phone +34 93 586 6200 | www.bbraun.com

AESCULAP® – a B. Braun brand

Aesculap AG | Am Aesculap-Platz | 78532 Tuttlingen | Germany
Phone +49 7461 95-0 | www.aesculap.com

D-ORS24011 1225/PDF/2