

Intracorporeal vs. extracorporeal open and closed suturing techniques in laparoscopy: A randomized, controlled study

Dr. Kathrin Labrosse^{*1}, Claudia Marinho^{*3}, Dr. Bernhard Fellmann-Fischer², Franziska Geissler¹, Andreas Schötzau², Prof. Viola Heinzelmann-Schwarz^{1,2}, Dr. Tibor Zwimpfer^{1,2}

^{*}contributed equally

1) Department of Gynecological Oncology, University Hospital Basel, 4031 Basel, Switzerland
2) Department of Biomedicine, University Basel and University Hospital Basel, 4031, Basel, Switzerland 3) Medical Faculty, University Basel, 4056 Basel, Switzerland



Background

Suturing is one of the most challenging tasks in laparoscopic surgery. Ensuring both the ease and speed of suturing has benefits not only for the surgeon, but can dramatically decrease operating time. Therefore, this study aimed to compare extracorporeal and intracorporeal suturing techniques using a Szabo pelvic trainer model from the Gynaecological Endoscopic Surgical Education and Assessment program.

Methods

57 medical students with no experience in laparoscopy performed intra- and extracorporeal knots using closed and open jaw knot pushers **Figure 2**. The participants watched an introductory video before each task, which demonstrated the aim of the task. Subjects were given twelve minutes to learn each technique. Afterwards, they were shown the laparoscopic instruments and given orally a brief explanation on how to use them. Using an artificial tissue suturing pad in a certified Szabo pelvic trainer, students made three knots using each technique according to block randomization. Task completion time, knot strength, knot-spread ability, and the number of errors were recorded. After completing the exercises, participants answered a questionnaire concerning the suturing techniques and their performance.

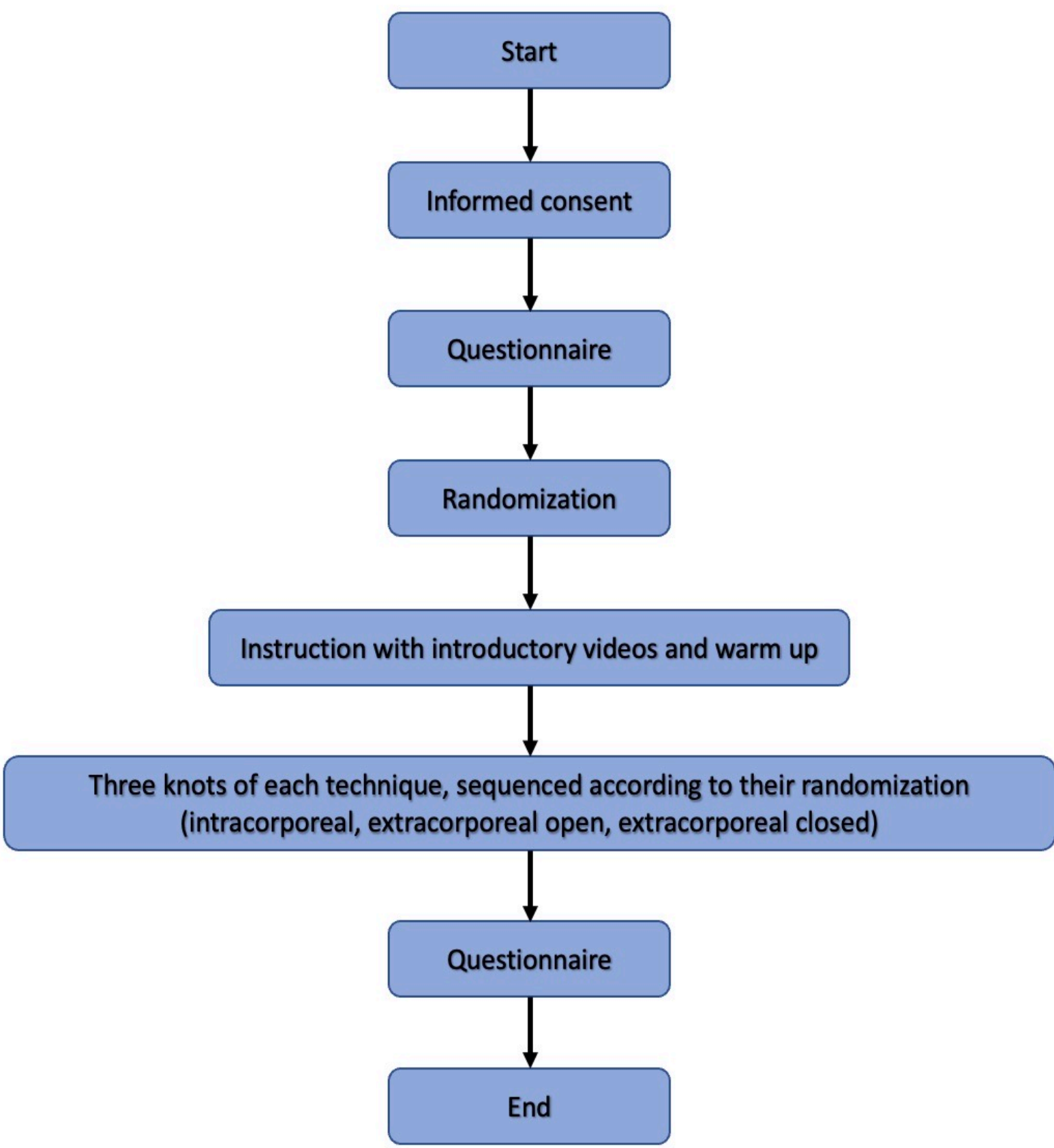
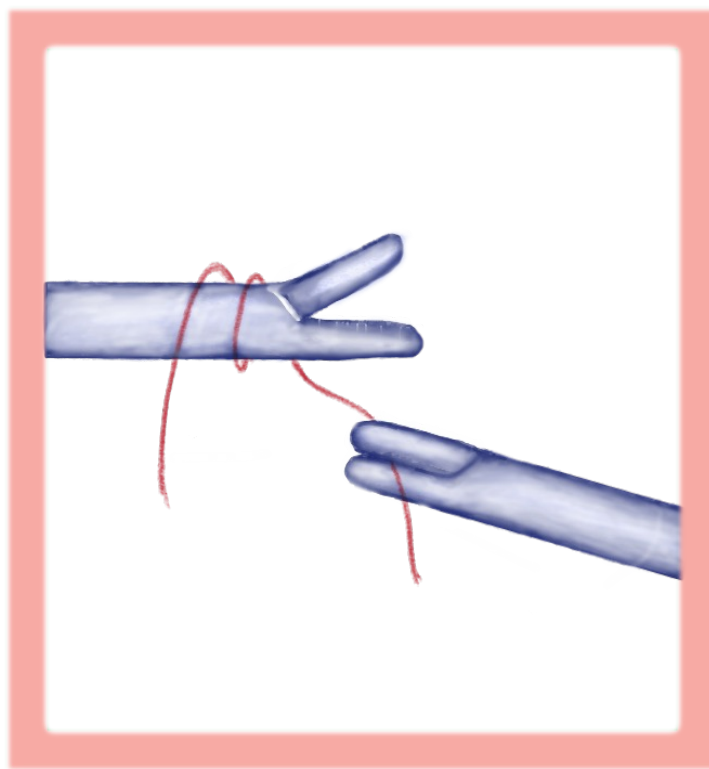
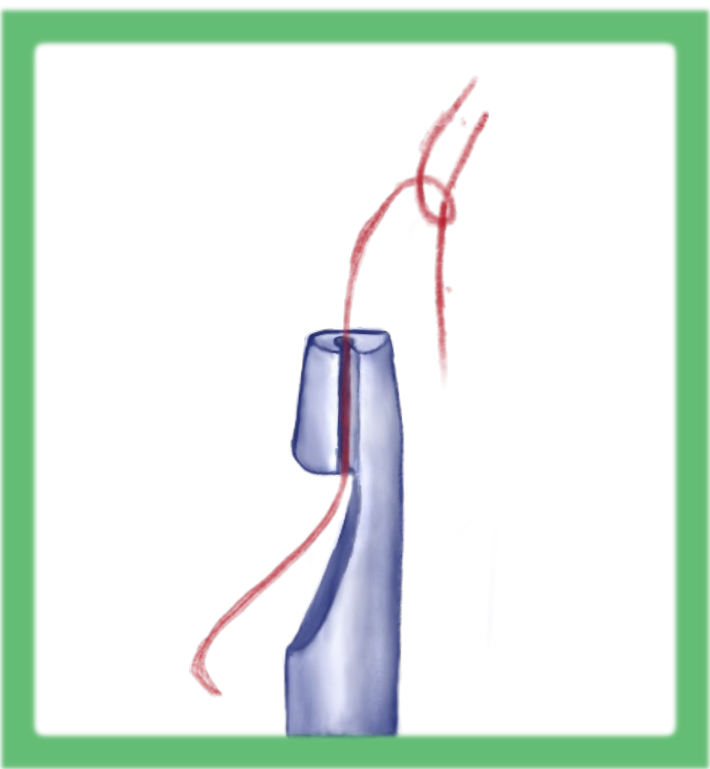


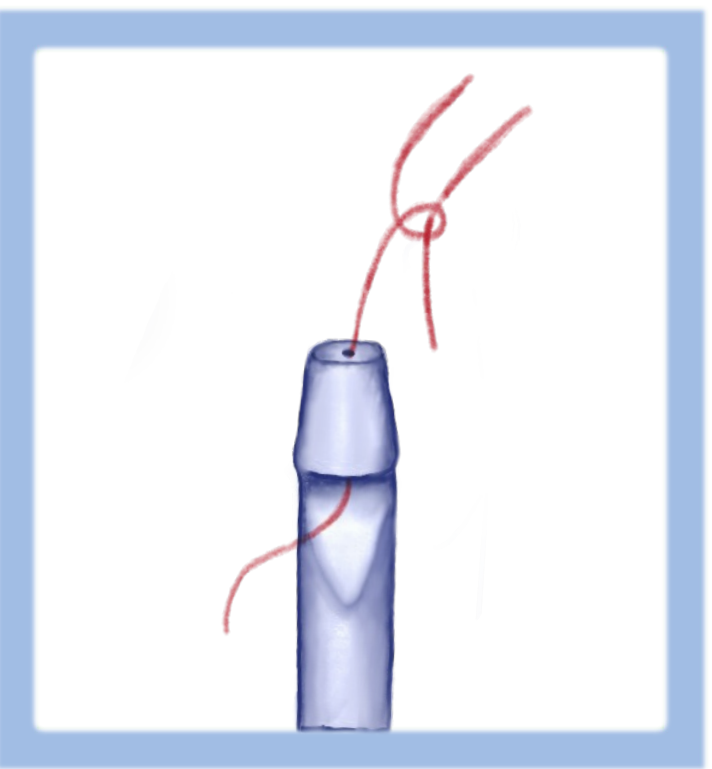
Figure 1. Flow diagram of the study design



Intracorporeal



Extracorporeal, open jaw



Extracorporeal, closed jaw

Figure 2. Knotting techniques

Results

- Open and closed extracorporeal suturing resulted to be significantly faster compared to the intracorporeal suturing ($p<0.001$, $p<0.001$)(**Figure 1A, Table1**).
- Open and closed extracorporeal suturing led to significantly less faulty trials ($p=0.007$, $p=0.003$) compared to the intracorporeal.
- The intracorporeal technique led to a significantly higher knot strength in contrast to the open extracorporeal method ($p=0.043$) (**Figure 1B, Table1**).
- Sutures made using the intracorporeal technique were significantly looser in contrast to those made with the extracorporeal open type jaw ($p<0.001$) and the closed type jaw ($p<0.001$) (**Figure 1C, Table1**).
- Open vs. closed jaw knot pushers were shown to be equal in regard to speed ($p=0.563$) (**Figure 1A**), knot spread ability ($p=0.49$) (**Figure 1C**) and precision ($p=0.831$).
- The open (30%) and closed (49%) extracorporeal suturing was rated as more intuitive than intracorporeal (21%) suturing (**Figure 4**).

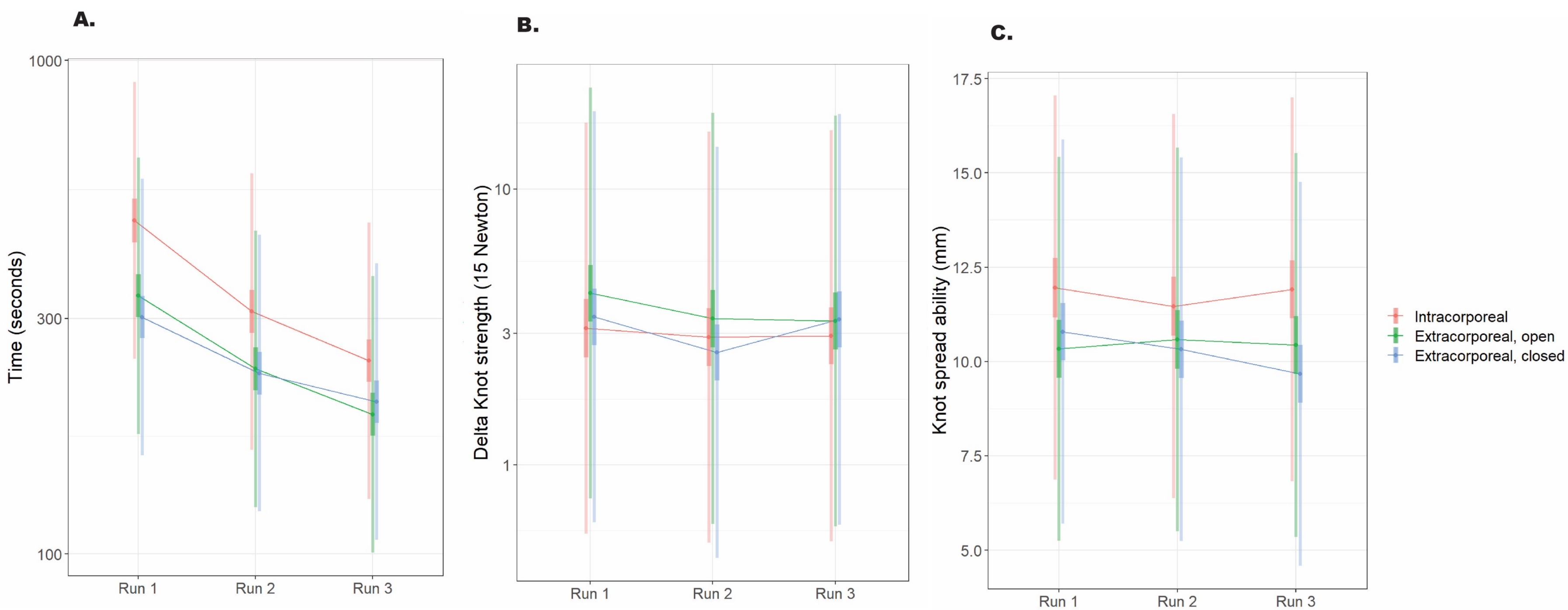


Figure 3. A comparison of the three different suturing techniques for all three runs for **A.** Time, **B.** Knot strength, and **C.** Knot-spread ability according to the geometric mean ratio

Parameter	Contrast	Ratio ^a	95% CI		p-value ^b
			Lower	Upper	
Time (sec)	Intracorporeal/ Extracorporeal, open	1.33	1.244	1.429	< 0.001
	Intracorporeal/ Extracorporeal, closed	1.361	1.27	1.458	< 0.001
Knot strength (mm)	Extracorporeal, open/ Extracorporeal, closed	1.02	0.953	1.093	0.563
	Intracorporeal/ Extracorporeal, open	0.827	0.688	0.994	0.043
	Intracorporeal/ Extracorporeal, closed	0.966	0.805	1.159	0.709
	Extracorporeal, open/ Extracorporeal, closed	1.168	0.975	1.4	0.092
Knot-spread ability (mm)	Intracorporeal/ Extracorporeal, open	1.328	0.782	1.875	< 0.001
	Intracorporeal/ Extracorporeal, closed	1.519	0.976	2.063	< 0.001
	Extracorporeal, open/ Extracorporeal, closed	0.191	-0.347	0.729	0.486

Table 1. Comparison of different suturing techniques by run time, knot strength and knot-spread ability.

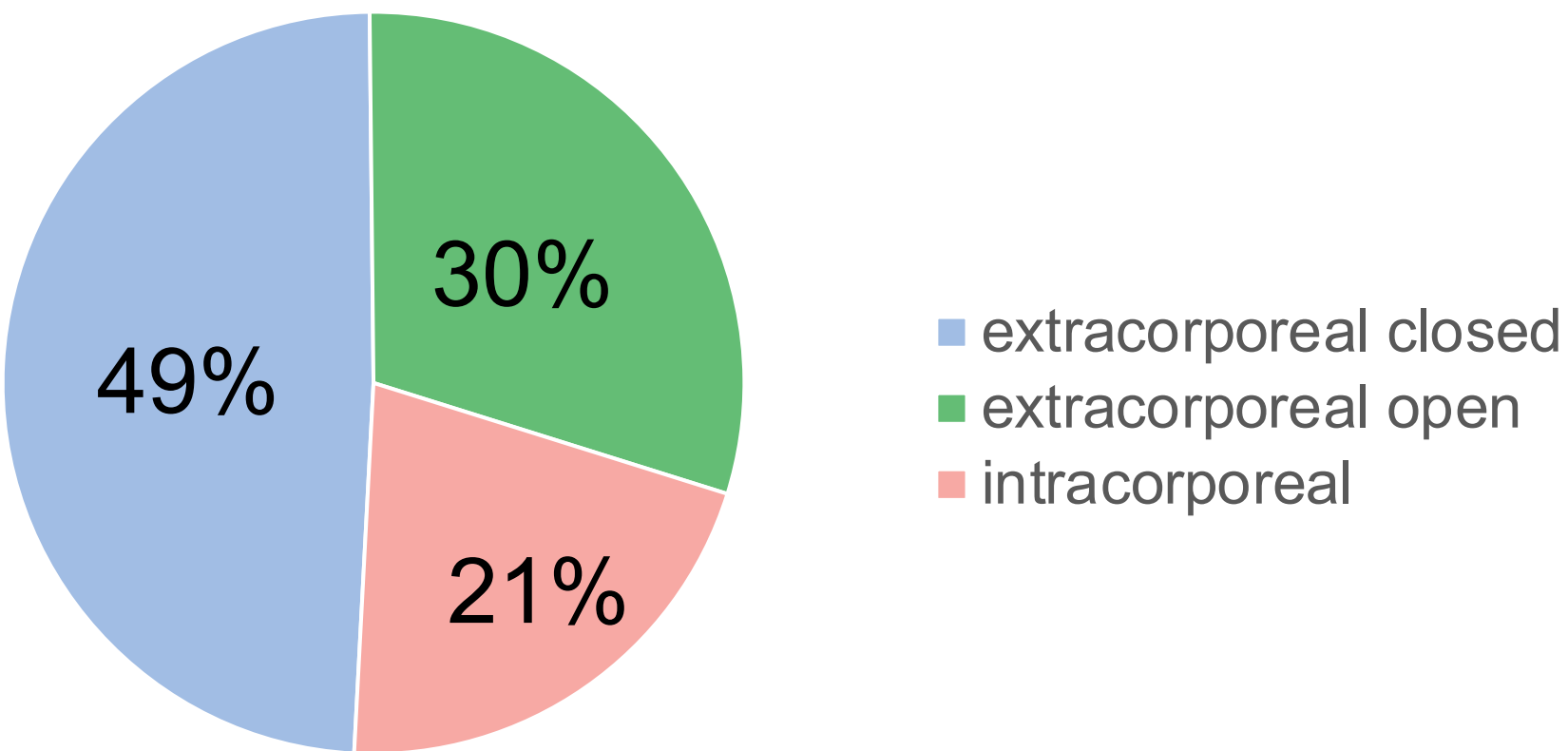


Figure 4. Evaluation of the questionnaire regarding the question of the most intuitive suturing method

Take Home Messages

- Beginners in laparoscopy should be encouraged to use extracorporeal suturing techniques.
- Extracorporeal suturing shows to be faster, simpler, and more reproducible in beginners.
- Non-experts find the extracorporeal suturing techniques more intuitive.