A novel modified four-port technique for laparoscopic cholecystectomy in patients with obesity: A Retrospective Cohort Study

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CONFLICT OF INTEREST DISCLOSURE

The study collaborators have no potential conflict of interest to report.

Background

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- Laparoscopic cholecystectomy (LC) – “gold standard” for management of gallstone disease
- Traditional four-port laparoscopic cholecystectomy (TFPLC) – well-described and safe
- TFPLC has technical challenges in patients with obesity
  - access and closure of the abdominal wall
  - visualisation and distance to the surgical field
- ↑ obesity incidence ⇒ ↑ caseload of LC in patients with obesity

Objectives

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- describes a modified four-port laparoscopic cholecystectomy (MFPLC) technique
- assess outcomes related associated with the MFPLC technique.

MFPLC – port arrangement

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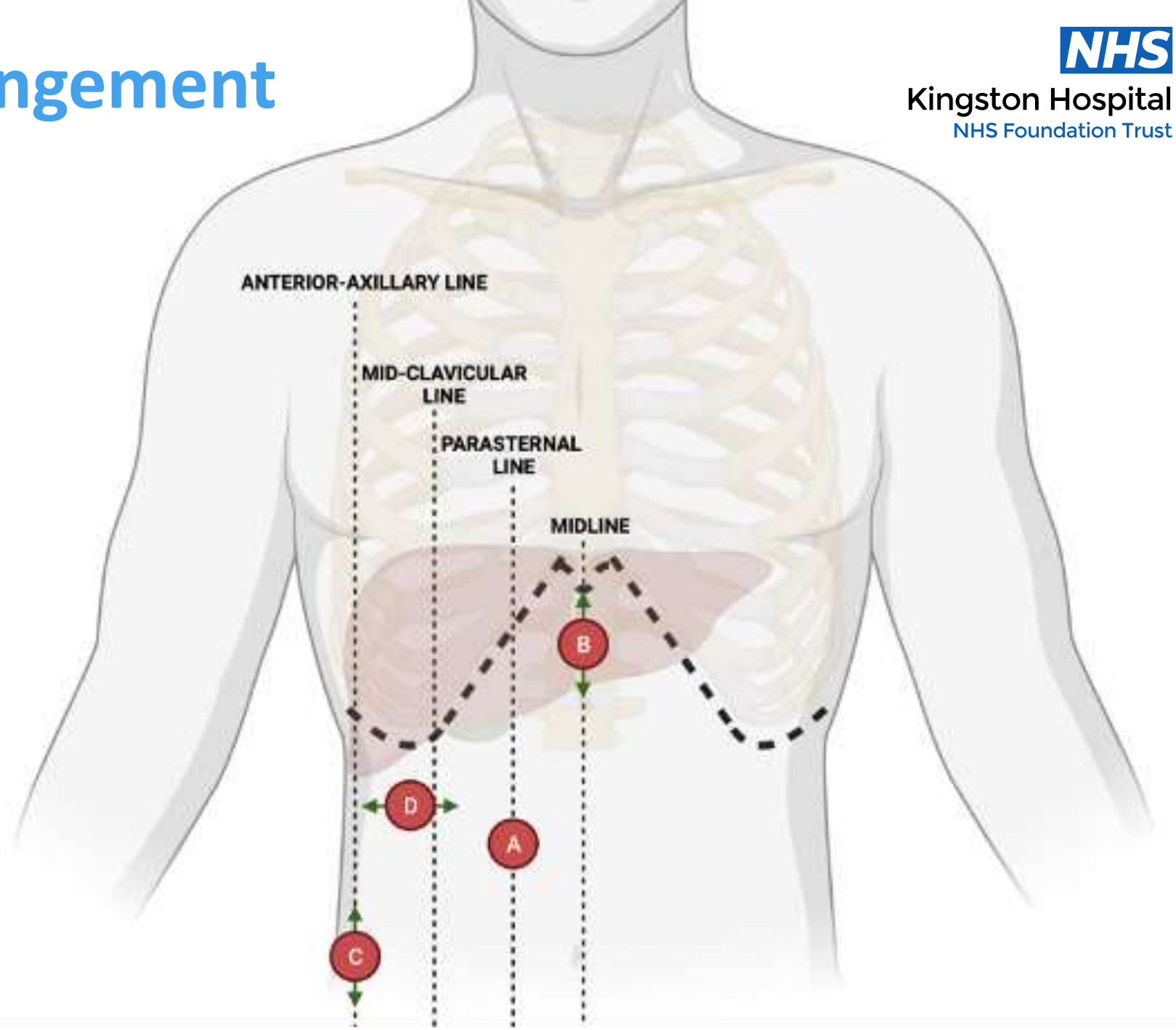
Port placement arrangement
In the supine position on the operating table, landmarks including xiphisternum, right costal margin, the midline, right parasternal line, mid clavicular line and anterior axillary line are marked. **A** – Camera port position, located 12cm caudally from the point where the right parasternal line crosses the costal margin. **B** – Subxiphoid, right hand working port site, variable distance in craniocaudal plane along midline. **C** – Right lateral retracting port site, located variable distance in craniocaudal plane along anterior axillary line. **D** – Right medial, left-hand working port site. Placed variable distance from midclavicular line.



MFPLC – optic trocar insertion

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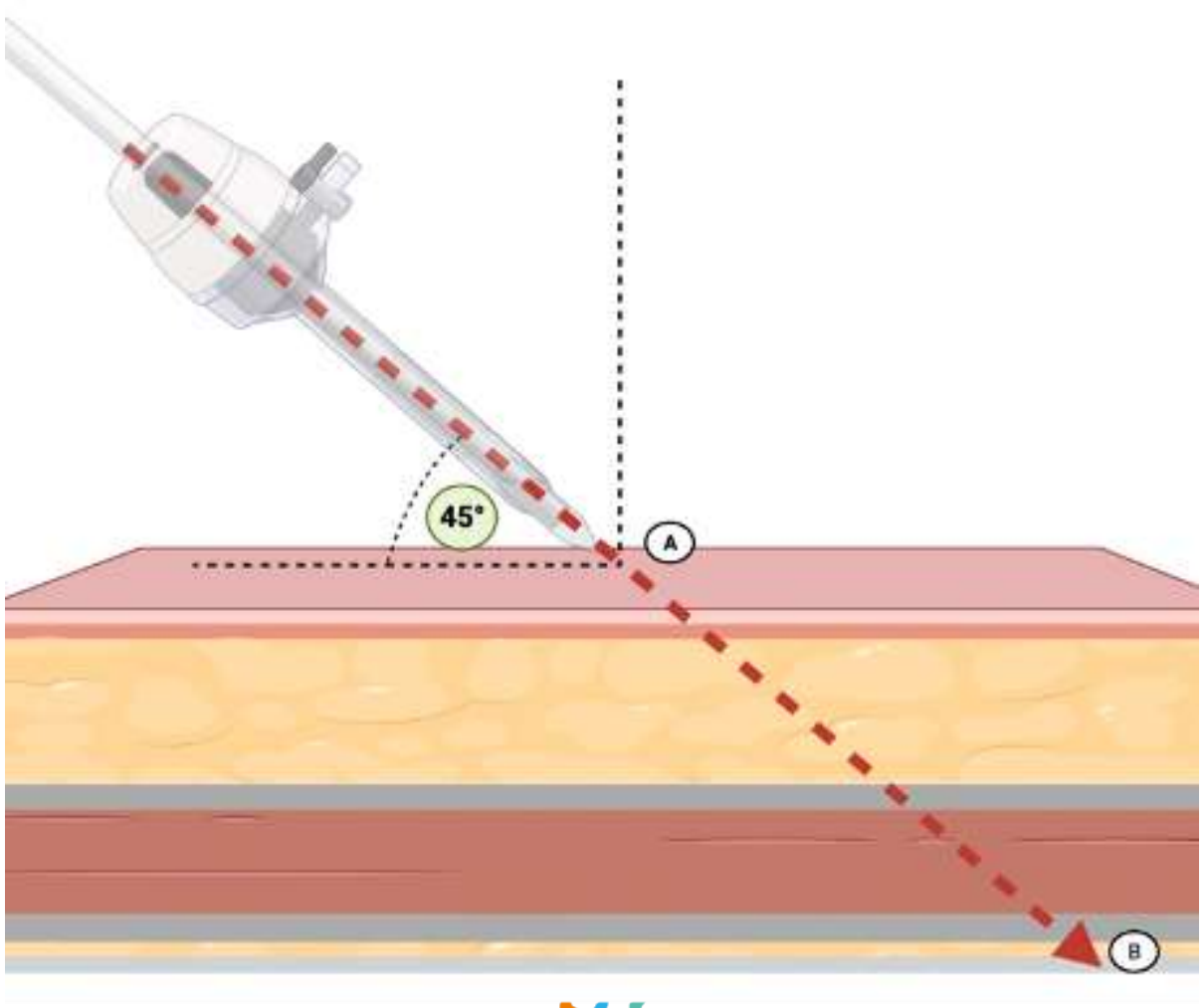
Optic trocar insertion.
The optic trocar is inserted using the 0-degree camera. The direction of insertion is at 45 degrees from the abdominal wall, directed towards the right shoulder. ***A*** *= Skin,* ***B*** *= Peritoneum.*



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Methods

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- retrospective cohort study
- all LC patients between 31/12/2019 – 31/12/2021.
- emergency and elective
- EHR data reviewed, including imaging
- telephone follow-up in January 2023 to identify missed complications

Methods

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- Propensity Score Matching (PSM):
  - Confounders: age, sex, and smoking status.
  - Nearest neighbour matching technique
  - Standardised differences < 0.1 considered a balanced match
- Regression Analysis:
  - Logistic and linear models to evaluate associations
  - Firth's correction for rare outcomes
- Subgroup Analysis:
  - Performed on matched patients, stratified by elective vs. emergency procedures.
  - P-value threshold of 0.05 for significant interactions

Table 1: Baseline characteristics

Table 1: Baseline characteristics of Unmatched and Propensity Score Matched Groups between patients that were treated with Parasternal and Peri-umbilical.

		Unmatched Groups	Matched Groups (Propensity Score)
	Parasternal (N= 75)	Peri-umbilical (N=156)	Peri-umbilical (N=75)
Age, years			
Mean (SD)	52.9 (15.5)	55.9 (16.2)	53.3 (14.8)
Sex at birth, N (%)			
Female	56 (74.7%)	94 (60.3%)	56 (74.7%)
Male	19 (25.3%)	62 (39.7%)	19 (25.3%)
Smoker, N (%)			
Never	57 (76%)	115 (73.7%)	57 (76%)
Current	11 (14.7%)	27 (17.3%)	11 (14.7%)
Former	7 (9.3%)	14 (9%)	7 (9.3%)
BMI, kg/m²			
Median (IQR)	35 (32.5, 38.8)	26 (24 , 28)	26 (24, 28)
Weight Category			
Underweight (BMI <18.5)	0 (0%)	1 (0.6%)	0 (0%)
Healthy Weight (BMI 18.5-25)	0 (0%)	47 (30.1%)	25 (33.3%)
Overweight (BMI 25-30)	1 (1.3%)	102 (65.4%)	47 (62.7%)
Obesity (BMI ≥30)	74 (98.7%)	6 (3.9%)	3 (4.0%)
Indication, N (%)			
Biliary colic	18 (22.5%)	48 (29.8%)	26 (33.8%)
Acute cholecystitis	42 (52.5%)	71 (44.1%)	33 (42.9%)
Gallstone pancreatitis	15 (18.75%)	31 (19.3%)	17 (22.1%)
Choledocholithiasis	0 (0%)	2 (1.2%)	0 (0.0%)
Gallbladder polyp(s)	0 (0%)	6 (3.7%)	0 (0.0%)
Chronic cholecystitis	1 (1.25%)	3 (1.9%)	1 (1.3%)
Mucocele	1 (1.25%)	0 (0.0%)	0 (0%)
Empyema	3 (3.75%)	0 (0.0%)	0 (0%)
Approach, N (%)			
Converted open	1 (1.3%)	0 (0%)	0 (0%)
Laparoscopic	74 (98.7%)	156 (100%)	75 (100%)
Emergency versus elective, N (%)			
Elective	28 (37.3%)	56 (35.9%)	21 (28.0%)
Emergency	47 (62.7%)	100 (64.1%)	54 (72.0%)
Grade of primary surgeon			
Consultant	61 (81.3%)	96 (61.5%)	48 (64.0%)
Trainee	14 (18.7%)	60 (38.5%)	27 (36.0%)

Table: Outcomes

Table X: Outcomes of Unmatched and Propensity Score Matched Groups between patients that were treated with Parasternal and Peri-umbilical

		Unmatched Groups		Matched Groups (Propensity Score)	
	Parasternal (N= 75)	Peri-umbilical (N=156)	*P-value*	Peri-umbilical (N=75)	*P-value*
Conversion to open, N (%)					
No	74 (98.7%)	156 (100%)	0.325	75 (100%)	1.000
Yes	1 (1.3%)	0 (0%)		0 (0%)	
Operative time, minutes					
Median (IQR)	78 (61.5, 111)	77 (58.8, 101.5)	0.552	81 (60, 103)	0.851
Length of stay, days					
Median (IQR)	1 (1, 2)	1 (1, 2)	0.720	1 (1, 1.5)	0.798
Need for ICU, N (%)					
No	70 (93.3%)	154 (98.7%)	0.038	74 (98.7%)	0.209
Yes	5 (6.7%)	2 (1.3%)		1 (1.3%)	
ICU stay, days					
Median (IQR)	0 (0, 0)	0 (0, 0)	0.026	0 (0, 0)	0.096
Bile leak postoperative, N (%)					
No	72 (96.0%)	153 (98.1%)	0.393	74 (98.7%)	0.620
Yes	3 (4.0%)	3 (1.9%)		1 (1.3%)	
GI injury, N (%)					
No	75 (100%)	156 (100%)	-	75 (100%)	-
Yes	0 (0%)	0 (0%)		0 (0%)	
Intrabdominal collection, N (%)					
No	70 (93.3%)	149 (95.5%)	0.532	71 (94.7%)	1.000
Yes	5 (6.7%)	7 (4.5%)		4 (5.3%)	
Port-site seroma, N (%)					
No	73 (97.3%)	154 (98.7%)	0.597	75 (100%)	0.497
Yes	2 (2.7%)	2 (1.3%)		0 (0%)	
Port-site haematoma, N (%)					
No	75 (100%)	153 (98.1%)	0.553	73 (97.3%)	0.497
Yes	0 (0%)	3 (1.9%)		2 (2.7%)	
Port-site hernia, N (%)					
No	74 (98.7%)	153 (98.1%)	1.000	74 (98.7%)	1.000
Yes	1 (1.3%)	3 (1.9%)		1 (1.3%)	

	MFPLC (n=__)	TFPLC	
		Before matching (n=__)	After matching (n=__)
BMI, kg/m²	25.8 (±)	36.2 (±)	
Operative Time, min	84.0 (±)	88.5 (±)	
Seromas, %	1.3	2.6	
Haematomas, %	0.0	1.9	
Port Site Hernias, %	1.3	1.9	
Port Site Infections, %	1.3	3.8	

Limitations

- single-centre, single-surgeon study
- small sample size
- retrospective design
- different study group demographics
- data on cosmesis, ergonomics and ease of use not captured
- follow-up variability

Conclusions

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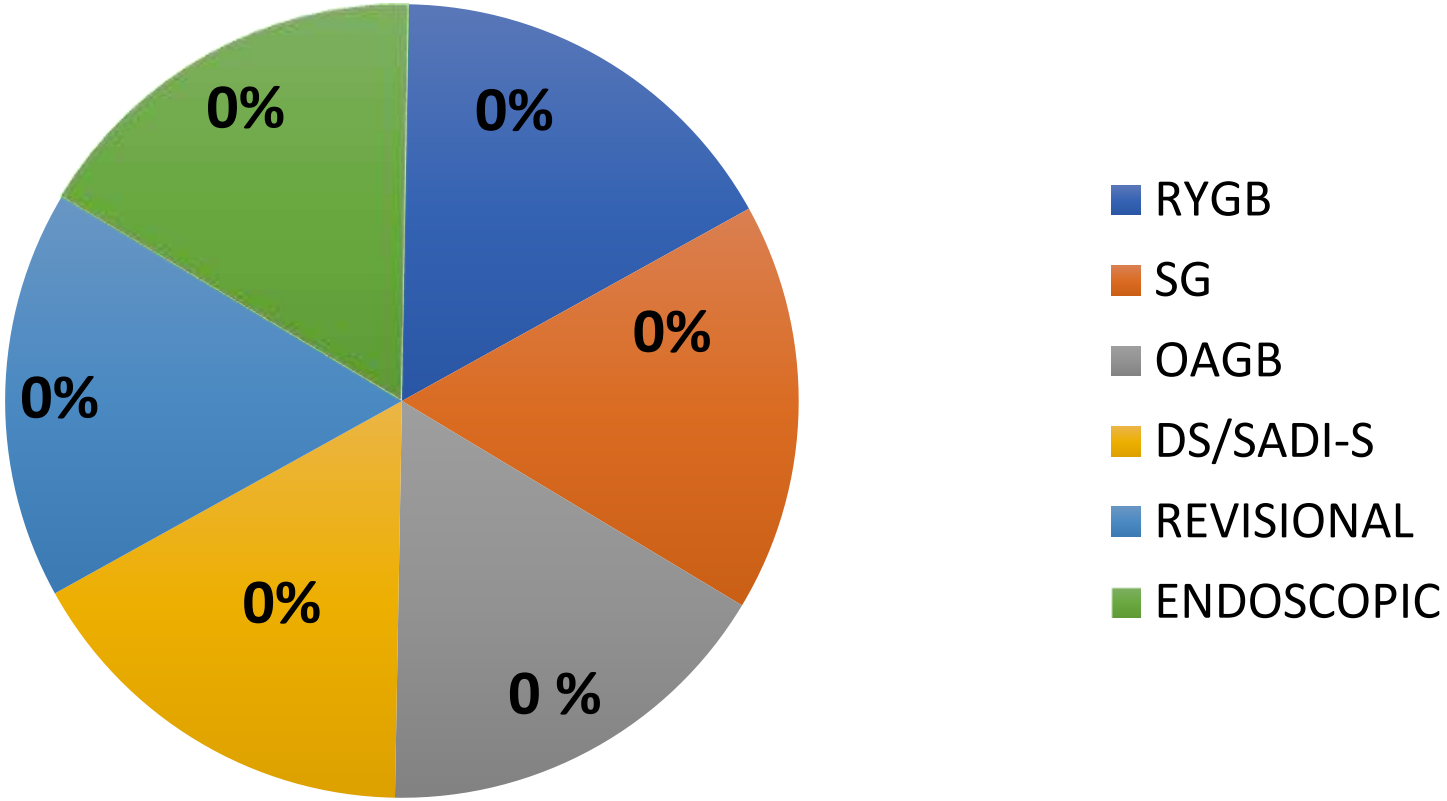
- MFPLC technique: **safe** and **efficient**
- **comparable outcomes**
- **addresses abdominal wall access** and **visualization** challenges in patients with obesity
- suitable for experienced surgeons and trainees
- larger, prospective studies needed to validate these findings and evaluate additional parameters

CASE MIX DISCLOSURE



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