Safety and Feasibility of Low-Pressure Pneumoperitoneum in Pediatric Laparoscopic Appendectomy: A Randomized Controlled Trial

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INTRODUCTION

- Laparoscopic appendectomy is the gold standard for the treatment of acute appendicitis in pediatric patients with reduced postoperative pain, shorter hospital stays, and faster recovery when compared to open appendectomy.[1]
  - Essential component of laparoscopic surgery is the creation of a pneumoperitoneum, with standard pressures set at 12-15mmHg.
  - Recent studies in adults suggest that lower intra-abdominal pressures may offer benefits without compromising the quality of the surgical procedure. [2]
- Low-pressure pneumoperitoneum (LP), pressures of 6-8mmHg, has gained attention in adult studies showing numerous benefits
  - Potential benefits include reduction in opioid analgesia, shorten hospital stays, and lead to a quicker return to normal activity[2,4]
  - Similar results have been demonstrated in several adult surgical subspecialties, such as colorectal surgery, in phase 3 clinical trials[3]
  - One study showed comparable operative times and post-operative complications in low-pressure laparoscopic pediatric inguinal hernia repairs[4]
- The applicability of LP in the setting of pediatic appendectomy for acute appendicitis remains unclear.

AIM

- Demonstrate efficacy of utilizing low pressure pneumoperitoneum when performing laparoscopic appendectomy for acute appendicitis in children under 16 years of age.

METHODS

• Study Design:
Single-center, randomized controlled trial evaluating low vs. standard pressure in laparoscopic appendectomy.

• Participants:
Enrolled patients aged 1-16 years, presenting directly or transferred to the emergency department.

• Randomization:
Patients were randomly assigned to Low or Standard Pressure groups, based on the day of the week (Even vs. Odd) in a single-blinded, rolling enrollment.

• Endpoints:
Primary: Ability to remain at low pressure.
Secondary: Operative duration, complications, postoperative pain (measured by pain scores and need for additional analgesics).
-Pain scores were collected by blinded nursing staff.

• Statistical Analysis:
Unpaired t-test with $p<0.05$ considered statistically significant.

• Procedure:
All patients received weight-based local anesthetic dosing and underwent laparoscopic appendectomy with three port sites.

RESULTS

	SP (15mmHg); n = 10	LP (8mmHg); n = 12	P-Value
Age (years)	11.9	9.4	0.157
Weight (Kg)	54.3	39.6	0.171
Performing Resident Level (PGY level)	3.4	3.3	0.817
Perforated Appendicitis	1	3	-
Conversion to SP	-	2	-

Table 1. Study demographics averages and significance between low pressure and standard pressure groups.

	SP (15mmHg); n = 10	LP (8mmHg); n = 10	P-Value
Operative Time (Min)	43.9	43.5	0.972
Post-Op Pain Score (0-10)	3.22	1.1	0.021
Additional Opioid Analgesic	2	2	-
Conversion to SP (Ports Only)	-	4	-
Operative Complications	0	0	-
Wound Infection	0	1	-

Table 2. Primary and secondary outcome averages between low pressure and standard pressure groups

- No significant differences in baseline demographics
- Two conversions to SP performed due to poor visualization without complication yielding 83.3% success rate for maintaining LP.
  - Patients excluded from Table 2
- No significant difference operative times between groups
- Notable difference in post-operative pain scores favoring the experimental arm
- Difficulty with port placement at low pressures

CONCLUSIONS

- Our study suggests that low-pressure pneumoperitoneum (LP) is a viable and safe alternative to standard-pressure pneumoperitoneum (SP) in pediatric laparoscopic appendectomy.
- Secondary outcomes consistent with other reports in pediatric laparoscopic surgery
  - Significant association with decreased post-operative pain scores
  - LP techniques may not always be sufficient for achieving optimal working conditions
  - Highlight need for flexibility in surgical techniques
- Limited by sample size providing preliminary data but does not allow for conclusions on long term outcomes of LP for pediatric laparoscopic appendectomy

FUTURE DIRECTIONS

- Larger, multicenter trials to confirm the safety, efficacy, and cost-effectiveness of LP compared to SP in children.
- Investigating other important outcomes, such as complications (e.g., abscess and postoperative ileus), quality of life post-surgery, and long-term complications

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