

Modified abdominal wall suspension system in gasless laparoscopy: a clinical application

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Summary

Introduction: The gasless laparoscopic technique is easily operable, safe, and avoids complications of pneumoperitoneum. The suspension method from two celiac wall rods evolved to a single wall rod method, reducing one hanging rod on one side of the abdominal wall. This benefited the surgeon which reduced the inhibition of one less visible, space-consuming suspension rod, however remains a hindrance to the assistant's optimal movement and visual field. **Objective:** To explore the feasibility and application value of a modified abdominal wall suspension system in standard gasless laparoscopic myomectomy. **Materials and Methods:** Women agreeing to participate were randomised into two arms. The standard conventional gasless method versus the modified abdominal wall lifting method. **Results:** A total of 100 women were randomised into two groups; the improvised technique (group 1) and the conventional technique (group 2). Surgical operating time (72.3 ± 35.6 minutes [improved] and 82.7 ± 31.9 minutes [conventional]) $p < 0.01$, total blood loss (204.9 ± 167.3 ml [improved] and 266.7 ± 190.5 ml [conventional], $p < 0.01$) and average time of a single-myoma-removal (improved vs. conventional) were significantly reduced in the improvised technique group, as opposed to the conventional technique group. No significant difference was found between the two groups with regards to postoperative intestinal function recovery period or the postoperative hospital stay duration. **Conclusion:** The modified abdominal wall suspension method increases the surgeon's operating space, making it more convenient and practical with significant rewarding postoperative surgical outcomes.

Key words: Gasless; Laparoscopy; Abdominal wall suspension; Myomectomy.

Introduction

The gasless laparoscopic technique has been popularised as a mini-invasive technique described to be easily operable, safe, and avoids complications of pneumoperitoneum. [1, 2] The gasless technique, originally a three-hole method (Figure 1) evolved to a two-hole method (Figure 2) and has been further modified to a single-hole method (Figure 3) surgery [3]. The suspension method from two celiac wall rods method evolved to a single point abdominal wall rod method, which reduced one hanging rod on one side of the abdominal wall. This benefited the surgeon which reduced the inhibition of one less visible, space-consuming suspension rod [4]. However, the present authors realised that the existing remaining single rod still presents as a disadvantage particularly to the surgeon's first assistant's movement and visual field [5]. In view of this remaining inconvenient issue, they devised a technique which uplifts the abdominal wall to the ceiling hoisted up by a hook attached to a chain installed to the ceiling of the operating theatre (Figures 4–6). They found that this technique eliminates the problem of a restricted surgical operative field and also provides better comfort zone for the surgeon and the first assistant. The

objective of this study was to explore the feasibility and application value of a modified abdominal wall suspension system in standard gasless laparoscopic myomectomy.

Materials and Methods

This was a randomised prospective study of women requiring myomectomy, performed in Hohhot First Hospital between December 2013 and December 2014. This study was approved by the local ethics committee of the hospital. Women aged more than 20 years old with myoma diameter ranging from 5–8 cm were included in the study. All patients were explained the procedure and consents were taken from all of them. All patients underwent pre-operative cervical cytology examination and hysteroscopic examination to rule out possible endometrial or cervical pathologies. Patients were then randomised using block randomisation to either improvised technique (group 1) or conventional technique (group 2). Both groups were operated by a same-skilled cohort of surgeons.

Of the study groups, the author collected data on surgical operation time, total surgical blood loss, intestinal function recovery period, as well as hospital stay duration. Statistical comparisons were made with SPSS13.0 using independent-samples *t*-test or chi-squared test and Fisher's exact test. A probability of < 0.05 was taken to be statistically significant.

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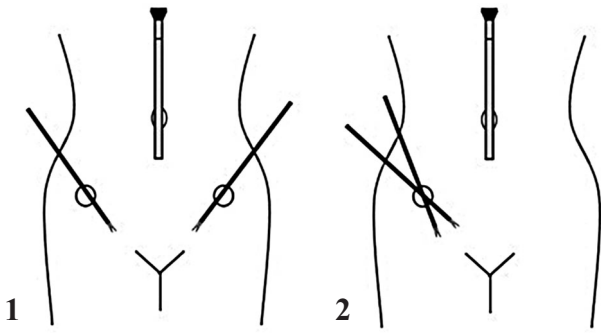


Figure 1. — Gasless three-hole method.

Figure 2. — Gasless two-hole method.

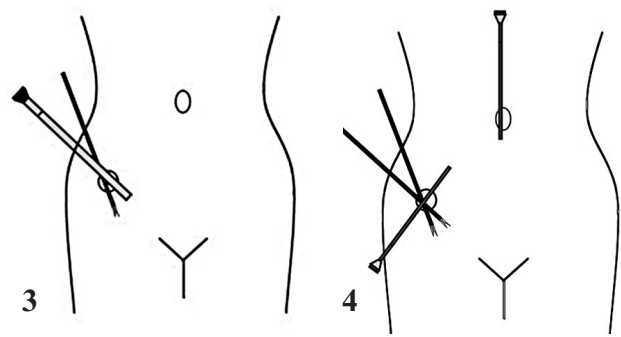


Figure 3. — Gasless one-hole method (with suspension rod).

Figure 4. — Gasless improvised technique (with chain hoist).

Results

A total of 100 women 28-47 year-old with myoma diameter ranged from 5-8 cm were randomised into two groups; the improvised technique (group 1) and the conventional technique (Group 2). Three cases of submucosal myomas requiring a combined laparoscopy-hysteroscopy [6] approach were excluded from this study. Two cases with severe pelvic adhesions requiring conversion to laparotomy were also not included in the study cohort. Finally there were 50 patients in the improvised technique (group 1) and 45 patients in the conventional technique (group 2).

Table 1 denotes the comparison of various leiomyoma sizes measured between the two groups. There was no statistically significant difference in terms of myoma size (5.8 ± 2.1 cm [conventional] and 6.6 ± 1.5 cm [improved]).

Statistical analysis revealed that the average operating time (72.3 ± 35.6 minutes [improved] and 82.7 ± 31.9 minutes [conventional]) and total blood loss (204.9 ± 167.3 ml [improved] and 266.7 ± 190.5 ml [conventional]) were significantly reduced ($p < 0.01$) in the improvised group compared to the conventional group as shown in Table 2.

A subanalysis of the average single myoma resection time was performed and showed a statistically significant difference ($p < 0.01$) of a shorter time in the improvised group compared to the conventional cohort (Table 3).

The postoperative intestinal function recovery period and the postoperative hospitalization stay duration showed no significant differences between both groups, as per Table 4.

Discussion

Uterine leiomyoma is the commonest benign gynaecological tumor in the female population between 30-50 years of age. The demand for myomectomies as opposed to total hysterectomies have increased in view of improved desire for uterine preservation, as well as benefits such as reducing the risks of premature ovarian failure (due to depletion of ovarian blood supply in hysterectomy) and early

menopause [7, 8].

Gasless laparoscopic surgery was a new technology in 1990s. It being gasless reduces the side effects of CO₂ pneumoperitoneum [9, 10] gas leakage, subcutaneous emphysema, as well as allow surgeons to use laparotomy instruments for ease of cutting, suturing, and knotting [11]. However, in the long run, the present authors realized that the traditional suspension rods affected the surgical field of the operators and thus the devised this improvised technique. They applied their technique and conducted a study to evaluate the efficacy of their method compared to the conventional style. The study clearly showed that the average operation time and total operative blood loss of the modified suspension group (72.3 ± 35.6 minutes and 204.9 ± 167.3 ml) were significantly less than those in the conventional method of suspension group (82.7 ± 31.9 minutes and 266.7 ± 190.5 ml; $p < 0.01$). The average single myoma resection time was also significantly shortened in the modified group.

The study however showed that there was no change with regards to the patients postoperative recovery time of the gastrointestinal tract and the length of hospital stay.

The present authors believe that this positive surgical outcome results from the fact that without the single suspension bar, the first assistant was better-abled to coordinate and assist the primary surgeon in completion of the surgery. In summary, the present authors suggest that this improvised technique of gasless laparoscopy is advantageous to patients as the skin trauma is smaller, has a shorter surgical period exposure, which can avoid plenty of potential damage to the cardiovascular, respiratory system, and other important organs caused by CO₂ pneumoperitoneum [12]. The gasless method is ideal for patients intolerant or those that have a high risk to artificial pneumoperitoneum, while providing an alternative approach [13] for the treatment of uterine leiomyomas with minimally invasive surgery.

Conventional laparoscopic myomectomy (with pneumoperitoneum) requires morcellation and an extended in-

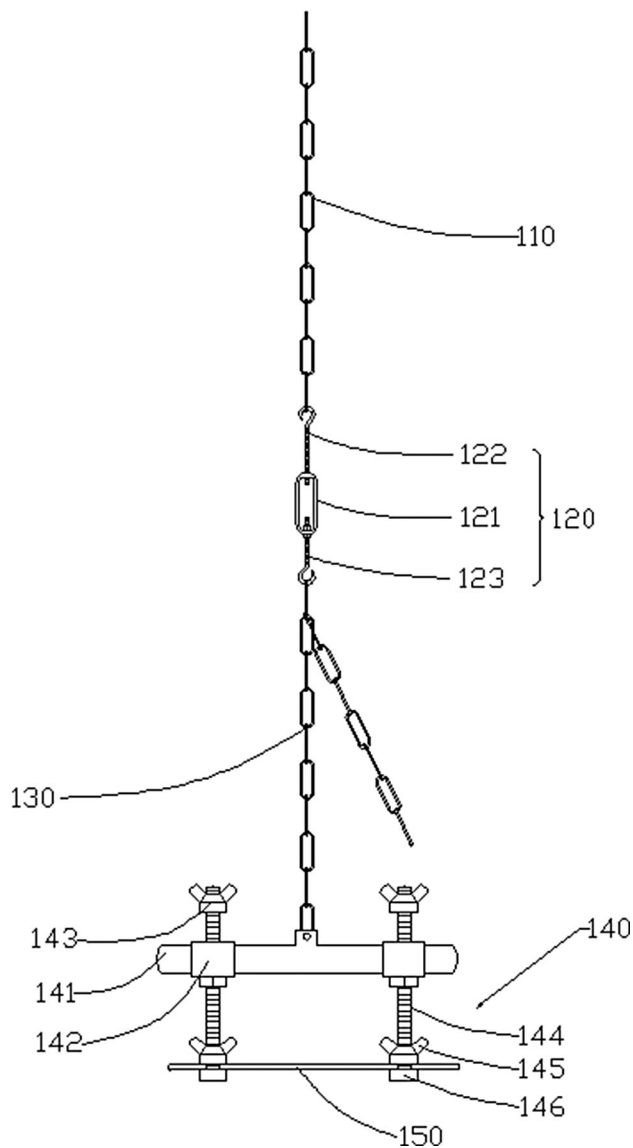


Figure 5. — Technical detailing of the improvised technique chain.
Reference No. 110 and 130: suspended chain hoist.
Reference No. 120: double suspension hook.
Reference No. 140: needle gripper.
Reference No. 150: needle.



Figure 6. — Real-life picture application of improvised technique chain hoist.

cision of approximately 13-15 mm for tissue extraction. Aesthetically, with the present method of suspension, there are almost no postoperative scars as the suspension incisional hole is small. With the incision made when the abdominal wall is suspended, upon dropping the wall back in place (post procedure), the incision becomes hidden.

Table 1. — Comparison of uterine fibroids, the average diameter of myoma, and the number of larger and smaller than 6 cm in two groups.

Group	Number of myoma [case (%)]	Average value of myoma ($\bar{x} \pm s$, cm)	Myoma diameter [case (%)]				
			3	4		< 6.5 cm	≥ 6.5 cm
Improved (n=50)	30 (63.0)	8 (15.2)	5 (8.8)	7 (13.0)	6.6 ± 1.5	33 (65.2)	17 (34.8)
Conventional (n=45)	28 (65.9)	7 (14.6)	6 (12.2)	4 (7.3)	5.8 ± 2.1	32 (70.7)	13 (29.3)
χ^2 / t	0.796*				3.84#	0.936*	
p	> 0.05				> 0.05	> 0.05	

Note: * = χ^2 , # = t .

Table 2. — Comparison of operation time and blood loss in the two groups ($x \pm s$).

Group	Case	Operation time (min)	Blood loss (ml)
Improved group	50	72.3 \pm 35.6	204.9 \pm 167.3
Traditional group	45	82.7 \pm 31.9	266.7 \pm 190.5
<i>t</i>		2.75	3.94
<i>p</i>		< 0.01	< 0.01

Table 3. — Comparison of the average time regarding myoma resection in the two groups ($x \pm s$, minutes).

Group	Case	Single myoma	Myoma diameter	
			< 6.5cm	\geq 6.5cm
Improved	50	16.5 \pm 6.8	17.4 \pm 4.7	21.6 \pm 9.3
Traditional	45	24.4 \pm 10.7	23.2 \pm 11.4	27.2 \pm 13.2
<i>t</i>		2.53	2.94	4.18
<i>p</i>		< 0.01	< 0.01	< 0.01

Table 4. — Comparison of the postoperative intestinal function recovery time in the two groups ($x \pm s$).

Group	Case	Intestinal function recovery time (hours)	Length of stay (days)
Improved	50	18.4 \pm 6.9	4.2 \pm 0.8
Conventional	45	16.6 \pm 7.3	4.0 \pm 0.6
<i>t</i>		18.36	22.49
<i>p</i>		> 0.05	> 0.05

This improved suspension method not only saves time and space, it also can greatly reduce the cost of surgical instruments, as basic laparotomy instruments can be used instead of the more expensive laparoscopic armamentarium (even a pneumoperitoneum machine insufflator is not needed). There is cause to believe that this method is suitable for usage in basic hospitals with entry level instruments which will encourage the continuity of minimally invasive surgical practice.

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References

- [1] Bickel A., Arzomanov T., Ivry S., Zveibl F., Eitan A.: "Reversal of adverse hemodynamic effect of pneumoperitoneum by pressure equilibration". *Arch Surg.*, 2004, 139, 1320.
- [2] Schwarte L.A., Scheeren T.W., Lorenz C., De Bruyne F., Fournell A.: "Moderate increase in intraabdominal pressure attenuates gastric mucosal oxygen saturation in patients undergoing laparoscopy". *Anesthesiology*, 2004, 100, 1081.
- [3] Li Bin., Ou Yangkeyong., Liu Tao.: "Application to gasless laparoscopic gynecologic surgery". *Chinese Journal of Obstetrics and Gynecology*, 2000, 35, 372.
- [4] Mathevet P., Nessah K., Dargent D., Mellier G.: "Laparoscopic management of adnexal masses in pregnancy: a case series". *Eur. J. Obstet. Gynecol. Reprod. Biol.*, 2003, 108, 217.
- [5] Jansen F.W., Kapiteyn K., Trimbos-Kemper T., Hermans J., Trimbos J.B.: "Complication of laparoscopy: a prospective multicentre observational study". *Br. Obstet. Gynecol.*, 1997, 104, 595.
- [6] Lin B.L., Higuchi T., Yabuno A., Kashinoura K., Suzuki T., Kim S.H., Iwata S., et al.: "One-step hysteroscopic myomectomy using Lin dissecting loop and Lin myoma graspers". *Gynecol. Minim. Invasive Ther.*, 2012, 1, 27.
- [7] Herrman A., DeWilde R.L.: "Laparoscopic myomectomy—The gold standard". *Gynecol. Minim. Invasive Ther.*, 2014, 3, 31.
- [8] Li Yin-feng.: "The application of suspensory laparoscopic surgery in gynecologic surgery". *Journal of Laparoscopic Surgery*, 2011, 16, 237. [Article in Chinese]
- [9] Wang Ping., Liu Jianhua., Li Hai.: "Comparative study of uterine myomectomy with laparo-lift laparoscopy and pneumoperitoneum laparoscopy". *Chinese Journal of Practical Gynecology and Obstetrics*, 2005, 21, 366.
- [10] Li Yin-feng., Liu Jian-hua.: "Lifting method of gynecological laparoscopic operation". *Beijing: People's Medical Publishing House*, 2004, 15.
- [11] Shi Wen-jing., Xiao Qian-kun., Zhang Zhao., Luo Yi-wen., Guo Yan-hong., Zhou Long-shu.: "Gasless laparoscopic myomectomy using subcutaneous abdominal wall-lifting system by one-trocar hole". *China Journal of Endoscopy*, 2011, 6, 611.
- [12] Shantha T.R., Harden J.: "Laparoscopic Cholecystectomy: Anesthesia-related complication and guidelines". *Surg. Laparosc. Endosc. Percutan. Tech.*, 1991, 1, 173.
- [13] Isaka K., Nakajima A., Ogawa T., Hosaka M., Kosugi Y., Suzuki Y., Koshiishi M., et al.: "Usefulness of newly developed subcutaneous one point lifting method in gynecological laparoscopic operation". *Nihon Sanka Fujinka Gakkai Zasshi*, 1996, 48, 53. [Article in Japanese]

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