The Outcome of Soft Silicone Drains in Reducing Shoulder Tip Pain after Laparoscopic Adrenalectomy

Wisa Anegmudchalin MD*,
Kamol Panumatrassamee MD*, Apirak Santi-ngamkun MD*

** Division of Urology, Department of Surgery, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand*

Background: *Intraabdominal carbon dioxide following laparoscopic adrenalectomy results in postoperative shoulder tip pain. Several interventions to reduce this pain have been used, but were not so effective.*
Objective: *To evaluate the efficacy of soft silicone drain in reducing shoulder tip pain after laparoscopic adrenalectomy.*
Material and Method: *A prospective randomized control trial was done on 38 patients undergoing laparoscopic adrenalectomy and randomized prospectively into two groups in King Chulalongkorn Memorial Hospital, Bangkok, Thailand. In our previous observational study, we collected data of pain scores from two patient groups after laparoscopic adrenalectomy. There were five cases with soft silicone drains and five cases without soft silicone drains. We found that those with drains had significantly decreased mean pain score. In this study, the patients were divided into two groups. Patients in group A (n = 19) underwent laparoscopic adrenalectomy with soft silicone drains and patients in group B (n = 19) underwent laparoscopic adrenalectomy without soft silicone drains. Shoulder-tip pain was recorded on a visual analogue scale (VAS) at 4, 8, 12, 24, and 48 hours after operation. The quantity of analgesics required by the patients were recorded on the first and second day postoperatively.*
Results: *Twelve patients in group A (63.2%) and 14 patients in group B (73.68%) complained of shoulder-tip pain. However, there was no significant difference in the frequency and intensity of shoulder-tip pain between groups A and B. The postoperative shoulder-tip pain scores were not significantly different between the groups. The quantity of analgesics required by the patients in the two groups were not significantly different. According to VAS, pain scores were found to be highest at the fourth and the eighth hours postoperatively. The trends were similar in both groups.*
Conclusion: *Although our previous observational studies found that drains help reducing shoulder tip pain, our present randomized control trial found that they could not significantly reduce shoulder tip pain. Further studies to reduce shoulder tip pain should be conducted.*

Keywords: *Shoulder tip pain, Soft silicone drain, Analgesic drug, Laparoscopy, Adrenalectomy*

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Nowadays, laparoscopic adrenalectomy has become the standard treatment of adrenal diseases because of its many advantages in different aspects, including postoperative pain, intraoperative bleeding, and length of postoperative hospital stay. Normally, there are two components of postoperative pain, parietal pain and visceral pain. The parietal pain is substantially reduced by laparoscopic adrenalectomy itself due to small incisions. However, the visceral pain usually results in shoulder-tip pain because the insufflated CO_2 into the abdominal cavity to create the surgical view can become entrapped between the liver and diaphragm causing irritation of the diaphragm through Phrenic nerve[1-10]. The incident of shoulder tip pain is found as high as 35 to 60% after laparoscopic surgery[1,2,11]. Shoulder tip pain is found to be highest at 4 to 8 hours postoperation and lasts as long as 72 hours[6].

Most of the earlier studies focus on the reduction of shoulder-tip pain after laparoscopic cholecystectomy by using intraperitoneal local anesthetic, intraperitoneal saline, low-pressure gas[5], perioperative analgesic drugs[4], and gas drain[1]. However, the reduction of shoulder tip pain after laparoscopic adrenalectomy has never been studied yet. In addition, based on the earlier studies, we started observational studies about shoulder tip pain after laparoscopic adrenalectomy among 10 patients undergoing laparoscopic adrenalectomy. We had five patients with drain and five without drain, at King Chulalongkorn Memorial Hospital, between August and November 2012. According to a numeric rating scale, it is found that the mean pain score is

Correspondence to:
Santi-ngamkun A, Department of Surgery, Faculty of Medicine, Chulalongkorn University, Bangkok 10250, Thailand.
Phone: +66-81-5525925
E-mail: Apirak.S@chula.ac.th

Table 1. Mean of pain score and SD in the observational studies

	Without drain		With drain	
Hours after operation	24	48	24	48
Mean of pain score	2.2	1.8	0.6	0.6
SD	2.04	1.30	0.55	0.55

significantly lower among those undergoing laparoscopic adrenalectomy with soft silicone drains (Table 1).

Therefore, the aim of the present study was to evaluate the efficacy of soft silicone drains in reducing shoulder tip pain after laparoscopic adrenalectomy.

Material and Method

At King Chulalongkorn Memorial Hospital, between December 2012 and November 2014, 38 patients that underwent elective laparoscopic adrenalectomy were enrolled in the present study based on the following inclusion and exclusion criteria. According to the inclusion criteria, the patients must have indications for laparoscopic adrenalectomy, be over 18 years old, and consent to the studies. The exclusion criteria, the patients must undergo bilateral laparoscopic adrenalectomy, be converted to open adrenalectomy, have such complications as massive hemorrhage, adjacent organ injuries, be unable to indicate their pain, and be allergic to opioid and paracetamol.

Thirteen male and 25 female patients, ages ranged from 22 to 73 were divided into two groups by block-of-four randomization. Nineteen patients in group A underwent laparoscopic adrenalectomy with 8 Fr soft silicone drains, whereas the other 19 patients in group B underwent laparoscopic adrenalectomy without soft silicone drains. The same routine preoperative preparation was conducted for all of the patients undergoing laparoscopic adrenalectomy. The surgeons did not know which group the patients were.

Approval for the study was obtained from the Institutional Ethics Committee and the informed consent from all patients.

The operations were all done under general anesthesia. After establishing the CO_2 pneumoperitoneum via Hasson's trocar (4-port incision for right laparoscopic adrenalectomy and 3-port incision for left laparoscopic adrenalectomy) intra-abdominal pressure was maintained at 12 mmHg in all patients of both groups. When the adrenal gland was removed outside the abdomen, the patient in group A were placed with soft silicone drains number 8 Fr (Fortune drain) at surgical point.

Shoulder-tip pain was measured by using a Visual Analogue Scale (VAS) at fixed time intervals of 4, 8, 12, 24, and 48 hours postoperatively. All patients were prescribed postoperative oral analgesia with paracetamol. If any patients could not tolerate the postoperative pain, additional parenteral opioids, including morphine, pethidine, and fentanyl, were given after the pain score had been recorded. The postoperative analgesic requirement was assessed by the equivalent doses of the administered morphine recorded at 24 and 48 hours.

All data were recorded concerning age, sex, weight, operative time (minutes), postoperative hospital stay (days), frequency and intensity of shoulder-tip pain, analgesic requirement during the postoperative period.

The data were analyzed using unpaired t-test, Chi-squared, and Mann-Whitney test (SPSS version 17.0). The significance was defined as $p<0.05$.

Results

Patients

Comparing the demographic characteristics (age, gender, and weight) and operative variables (operative time and postoperative hospital stay) of patients in both groups, there were no differences between them (Table 2). The operating time for group A was 106.05 minutes, which was longer than 92.11 minutes for group B, however, there was no significant difference. As for the postoperative hospital stay, there was no difference between the two groups (A: 3.52 days, B: 3.15 days).

In the present study, 26 (68.42%) from 38 patients including 12 patients (63.2%) in group A and 14 patients (73.7%) in group B reported to have postoperative shoulder-tip pain during the first 48 hours after operation. Although the incidence of postoperative shoulder-tip pain was higher in group B, there was no significant difference (Table 3).

The highest number of patients with shoulder tip pain were found at the 24th hour postoperatively, which was eight in group A (42.12%) and 11 in group B (57.9%). However, there was no significant difference between the groups. The mean score of shoulder tip pain in both groups had similar mean score at every recording time; 4, 8, 12, 24, 48 hours postoperatively. There was no significant difference as

shown in Table 4. The mean score of shoulder tip pain was high at 4 and 8 hours postoperatively and then decreased. There is no significant difference in both groups as shown in Fig. 1.

Analgesic use

Analgesic requirement for shoulder-tip pain were not significantly different in both groups. However, morphine administration was lower in group B at 24 to 48 hours postoperatively than in group A at 0.47 mg (Table 5).

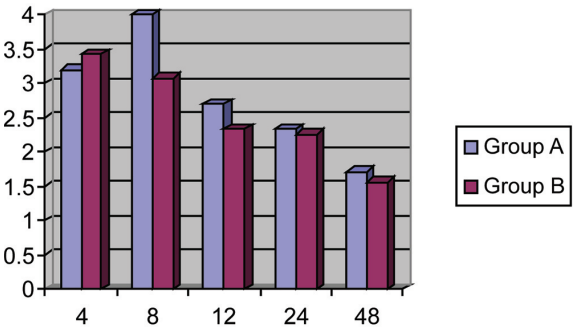

Fig. 1 Pain score according to the time after operation (hours).

Table 2. Demographic characteristics and operative variables

Characteristic	Group A	Group B	*p*-value
Age (years)	50.26±15.21	41.42±15.02	0.129
Sex (male:female)	8:11	5:14	0.495
Weight (kg)	74.97±12.76	72.29±19.04	0.645
Operating time (minutes)	106.05±31.02	92.11±29.12	0.071
Postoperative hospital stay (days)	3.52±1.17	3.15±1.50	0.154

Table 3. Number of patients and timing of postoperative shoulder-tip pain

Time after operation (hours)	Group A	Group B	*p*-value
4	7 (36.8%)	10 (52.6%)	0.515
8	6 (31.6%)	4 (21.1%)	0.714
12	5 (26.3%)	4 (21.1%)	1
24	8 (42.12%)	11 (57.9%)	0.517
48	5 (26.3%)	7 (36.8%)	0.728

Table 4. Mean scores of postoperative shoulder-tip pain

Time after operation (hours)	Group A	Group B	*p*-value
4	3.20±1.27	3.42±1.80	0.337
8	4.00±1.76	3.07±1.78	0.292
12	2.70±1.55	2.33±0.79	0.586
24	2.33±0.79	2.25±1.63	0.606
48	1.72±0.70	1.56±0.87	0.675

Discussion

Pain after laparoscopic adrenalectomy may occur transiently or persistently for about 72 hours[6]. CO_2 remains in the sub-diaphragmatic space after laparoscopic adrenalectomy for more than 24 hours[6,7]. CO_2 is converted to carbonic acid on the moist peritoneal surfaces irritating the diaphragm and leading to refer shoulder and neck pain. Therefore, we recorded pain scores for 48 hours postoperatively.

Despite laparoscopic adrenalectomy's advantages in many aspects, including postoperative pain, intraoperative bleeding, and length of post-operative hospital stay; unfortunately, the problem of shoulder tip pain could arise. This may result in the patients' discomfort and extended length of postoperative hospital stay. Therefore, many pain reduction methods are sought.

Jolis et al have found that intraperitoneal Bupivacaine did not significantly affect any of the different components of postoperative pain[1].

Salri et al found that lower carbon dioxide pneumoperitoneum pressure than that usually utilized to perform laparoscopic surgery reduced both the frequency and intensity of shoulder-tip pain following laparoscopic cholecystectomy[2].

Wills et al found that although many methods of analgesia produce short-term benefits, this did not

Table 5. Total parenteral morphine and paracetamol usage in patients with shoulder-tip pain

Analgesic drug	Group A	Group B	*p*-value
Morphine			
Mean dosage at 24 hour (milligram)	18.16±7.80	18.00±5.30	0.93
Mean dosage at 48 hour (milligram)	2.47±6.76	0.47±1.50	0.22
Paracetamol			
Mean dosage at 24 hour (milligram)	368.00±597.26	315.79±671.04	0.8
Mean dosage at 48 hour (milligram)	1,315.80±1,668.40	1,368.40±1,342.07	0.915

result in earlier discharge or improved postoperative function[6].

Suginami et al[7] found that abdominal filling with saline at the end of laparoscopic surgery effectively evacuates residual CO_2 thus preventing post laparoscopic shoulder tip pain. However, Esmat et al[4], using different levels of CO_2 pneumoperitoneum pressure and normal saline postoperatively, found that low pneumoperitoneum pressure can significantly reduce shoulder tip pain. Nevertheless, normal saline only reduced the intensity but not the frequency of shoulder tip pain[4,7].

Alexander et al, trying to reduce pain after laparoscopy, so they left a drain for 6 hours in the peritoneal cavity through the umbilical incision to take advantage of visceral peristaltic and voluntary muscle movements to expel residual gas. They found that the severity of pain was also significantly reduced in the first 6 hours[10].

All of the aforementioned studies, except Alexander's, cannot reduce shoulder tip pain significantly in laparoscopic cholecystectomy and gynecological laparoscopic surgery. Therefore, we conducted a study to reduce shoulder tip pain in laparoscopic adrenalectomy by using drains as he did.

To avoid drain-related pain and intra-abdominal infection, we used a small soft silicone 8 Fr drain in the present study and removed it 48 hours after the operation.

During the intra-operative period, there was no limit of analgesic drugs. If anesthesiologists thought it was needed, they would record the doses of opioid as equivalent to morphine, so we could compare the doses in group A and B.

The higher pain scores, the more analgesic required. In analyzing shoulder tip pain, we compared frequency, intensity, and analgesic requirements and found no differences. The pain scores and the analgesic drug requirements always grew accordingly. Like earlier studies in laparoscopic cholecystectomy, it is found that shoulder tip pain after laparoscopic adrenalectomy lasts more than 8 hours after the operation.

Conclusion

According to our observational studies, shoulder tip pain in those patients with drain was less than those without drain. However, in our randomized control trial, it was found that soft silicone drains could not reduce the number of patients complaining of shoulder-tip pain as well as the frequency and the intensity of their pain after laparoscopic adrenalectomy. Therefore, further studies to reduce shoulder tip pain after laparoscopic adrenalectomy with other modalities than drains should be conducted.

What is already known on this topic?

Postoperative shoulder tip pain is still a problem for the patients after laparoscopy, including laparoscopic adrenalectomy. Several authors believed that the insufflated CO_2 into the abdominal cavity to create the surgical view can become entrapped between the liver and diaphragm causing irritation of the diaphragm through Phrenic nerve. Many interventions were created to relieve the symptom, but not so effective.

What this study adds?

From our observational study and previous reports showed that soft silicone drain could reduce shoulder tip pain postoperatively. Therefore, we conducted a randomized control trial in patients underwent laparoscopic adrerenalectomy. We found that the soft silicone drain cannot reduce the shoulder tip pain as we expected.

Potential conflicts of interest

None.

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ผลการศึกษาการใช้สายระบายซิลิโคนขนาดเล็กเพื่อลดอาการปวดไหล่หลังการผ่าตัดตัดต่อมหมวกไตผ่านกล้อง

วิศา อเนกมุจลินท์, กมล ภานุมาตรัศมี, อภิรักษ์ สันติงามกุล

ภูมิหลัง: *ภาวะปวดไหล่หลังจากการทำผ่าตัดตัดต่อมหมวกไตด้วยกล้องผ่านช่องท้องนั้นพบได้ค่อนข้างบ่อย ได้มีการคิดค้นวิธีเพื่อช่วยลดอาการหลายอย่าง แต่ยังไม่ค่อยได้ผลที่ดีนัก*

วัตถุประสงค์: *เพื่อศึกษาการใช้สายระบายซิลิโคนขนาดเล็กเพื่อลดอาการปวดไหล่หลังผ่าตัด*

ชนิดการศึกษา:

วัสดุและวิธีการ: *การศึกษาทดลองแบบสุ่มตัวอย่างผู้ป่วยที่ได้รับการผ่าตัดตัดต่อมหมวกไตผ่านกล้องจำนวน 38 ราย จากการศึกษาแบบเฝ้าสังเกตหลังการผ่าตัดตัดต่อมหมวกไตผ่านกล้องจำนวน 10 ราย พบว่าผู้ป่วยที่ได้รับการวางสายระบายซิลิโคนขนาดเล็กสามารถลดอาการปวดไหล่ได้อย่างชัดเจนเมื่อเทียบกับกลุ่มที่ไม่ได้รับ จึงได้มีการทำการศึกษาแบบสุ่มโดยแบ่งเป็นผู้ป่วยที่ใส่สาย 19 ราย (กลุ่ม A) และผู้ป่วยที่ไม่ได้ใส่สาย 19 ราย (กลุ่ม B) โดยมีการบันทึกคะแนนของอาการปวดของไหล่ที่ 4, 8, 12, 24 และ 48 ชั่วโมงหลังผ่าตัด นอกจากนั้นยังได้มีการบันทึกถึงปริมาณยาแก้ปวดที่ใช้เพื่อเปรียบเทียบกันระหว่าง 2 กลุ่ม*

ผลการศึกษา: *ผู้ป่วยกลุ่ม A มีอาการปวดไหล่ 12 ราย (63.2%) กลุ่ม B มีอาการ 14 ราย (73.68%) ผลการศึกษาพบว่าทั้งสองกลุ่มไม่พบความผิดปรกติในจำนวนครั้งและความรุนแรงของอาการปวดไหล่อย่างมีนัยสำคัญทางสถิติ นอกจากนั้นยังไม่พบว่ามีความแตกต่างของปริมาณยาแก้ปวดที่ใช้ อาการปวดไหล่จะพบมากสุดที่ชั่วโมงที่ 4 และที่ 8 หลังจากนั้นจะค่อย ๆ ลดลงทั้งสองกลุ่ม*

สรุป: *แม้ว่าจะพบหลักฐานจากการศึกษาอื่น รวมทั้งการศึกษาเฝ้าสังเกตในระยะแรกว่าการใส่ที่ระบายซิลิโคนขนาดเล็กอาจช่วยในการลดอาการปวดไหล่ แต่หลังจากทำการศึกษาแบบสุ่มเพื่อพิสูจน์ ปรากฏว่าไม่พบความแตกต่างของการปวดไหล่อย่างมีนัยสำคัญทางสถิติของกลุ่มที่ใส่และไม่ใส่ ดังนั้นจึงควรมีการศึกษาอื่นเพื่อลดอาการปวดดังกล่าวต่อไป*