ORIGINAL PROF-715

LAPAROSCOPIC CHOLECYSTECTOMY;
LOW-PRESSURE PNEUMOPERITONEUM FOR SHOULDER-TIP PAIN

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A B S T R A C T

Background: Postoperative shoulder tip pain occurs frequently following laparoscopic cholecystectomy. The aim of this randomized clinical trial was to evaluate the efficacy of a low pressure carbon dioxide pneumoperitoneum during laparoscopic surgery in reducing the incidence of postoperative shoulder tip pain. Material & Methods: Ninety consecutive patients undergoing laparoscopic cholecystectomy were randomized prospectively into low pressure (group A) and normal pressure (group B) laparoscopic cholecystectomy groups. Patients in group A (n=46) underwent laparoscopic cholecystectomy with 10 mm Hg carbon dioxide pneumoperitoneum during most of the operation and those in group B (n=44) had laparoscopic cholecystectomy with 14 mmHg pneumoperitoneum. Shoulder tip pain was recorded on a visual analogue pain scale 1,3,6,12, 24 and 48 hours after operation. Results: The low pressure pneumoperitoneum did not increase the duration of surgery. There were no significant intraoperative or postoperative complications in either group. Fourteen patients (32%) in group B and five (11%) in group A complained of shoulder pain. Mean shoulder tip pain scores at 12 and 24 hours and postoperative analgesia requirements were also significantly lower in the low pressure laparoscopic cholecystectomy group. Conclusion: A carbon dioxide pneumoperitoneum pressure lower than that usually utilized to perform laparoscopic surgery reduces both the frequency and intensity of shoulder tip pain following laparoscopic cholecystectomy.

INTRODUCTION

Laparoscopic cholecystectomy has become the treatment of choice for many patients with symptomatic cholelithiasis. The advantages of laparoscopic cholecystectomy include:

- Avoidance of an upper abdominal incision
- Limited postoperative pain
- Improved pulmonary function tests
- Shorter hospitalization
- Earlier resumption of activity
- Improved cosmesis

Although laparoscopic cholecystectomy (LC) results in less pain than open cholecystectomy, it is not a pain free procedure.

Shoulder tip pain frequency occurs after laparoscopic cholecystectomy, making postoperative recovery less comfortable. The aetiology of postoperative pain is extremely complex and a precise evaluation of the various causes is still difficult to achieve.

Carbon dioxide insufflation is the commonest means of achieving pneumoperitoneum and carbon dioxide gas is widely considered to be responsible for postoperative pain. In particular, shoulder tip pain is presumed to be linked to carbon dioxide insufflation, and its intensity is often so strong that analgesics must be administered frequently. The reported incidence of this particularly uncomfortable type of pain varies

from 35 to 63% following gynaecological procedures[1,2]. In addition, the reported incidence of shoulder-tip pain following laparoscopic cholecystectomy varies between 30 and 50%[3,4]. Various efforts have been made to reduce these high frequencies including non-steroidal anti-inflammatory drugs, intraperitoneal local anaesthetic, intraperitoneal saline, a gas drain, healed gas, low pressure gas and nitrous oxide pneumoperitoneum. However until now none of the procedures has been proved to be practical and effective enough for routine clinical use.

The aim of this prospective randomized study was to assess the influence of low pressure pneumoperitoneum on the frequency and intensity of shoulder tip pain in patients undergoing laparoscopic cholecystectomy.

MATERIAL & METHODS

Randomization criteria included consecutive adult patients undergoing elective laparoscopic cholecystectomy for chronic calculus cholecystitis between Feb 2002 to Dec 2002. Three patients were excluded before randomization because in two an emergency cholecystectomy and in one exploration of the common bile duct was planned.

Laparoscopic cholecystectomy in this study was performed according to the European four puncture technique described by Dubois et al[5] Before induction of anaesthesia, patients were randomized prospectively by drawing cards labelled either "A" or "B". Patients in group A underwent laparoscopic cholecystectomy with a short duration of high pressure (14 mm Hg) carbon dioxide pneumonperitoneum followed by a low pressure (10 mm Hg) carbon dioxide pneumoperitoneum and those in group B had high pressure (14 mmHg) carbon dioxide pneumoperitoneum all the time.

In all cases the same balanced anaesthetic routine was used, including an induction drug (Thioentone Sodium) an opiod (Nalbuphine) and a mixture of 60-70 % air and 40-30% oxygen. Neuromuscular block was facilitated with atracurium and reversed with an anticholinesterase agent (Neostigmine).

In all cases residual carbon dioxide pneumoperitoneum was evacuated at the end of the procedure by compressing the abdomen, taking care to keep the trocar valves open. A drain was left for 24 h in the gallbladder fossa. Duration of surgery, intraoperative gas consumption and the occurrence of bile spillage during operation were recorded. All patients were prescribed postoperative analgesia with intramuscular diclofenac sodium and intravenous opiod, if required.

The degree of postoperative shoulder tip pain was assessed by means of a visual analogue pain scale ranging from 0 (no pain) to 10 (unbearable pain), 1 h after the patients had been placed in the recovery room and at 3, 6, 12, 24 and 48 hr thereafter. Patients were made aware that the scale served to analyse the presence and intensity of shoulder tip pain alone and was not a representation of generalized postoperative discomfort. The frequency with which shoulder tip pain was reported laparoscopic cholecystectomy was also documented. Analgesic requirements of all the patients in the postoperative period and length of postoperative hospital stay were also recorded.

RESULTS

Ninety four patients were randomized of whom four were with drawn from the study as laparoscopy was converted to an open procedure.

DEMOGRAHIC DATA

Table-I

	Group A (n=46)	Group B (n=44)
Age	20-52 (mean: 36	25-54 (Mean: 39.5)
Male	14	17
Female	32	27

Table-II. Duration of surgery and Length of Hospital stay

	Group A (n=46)	Group B (n=44)
Mean duration	1.7 hrs	1.5 hrs
Mean Hosp stay	2.5 days	2.4days

CARBON DIOXIDE CONSUMPTION

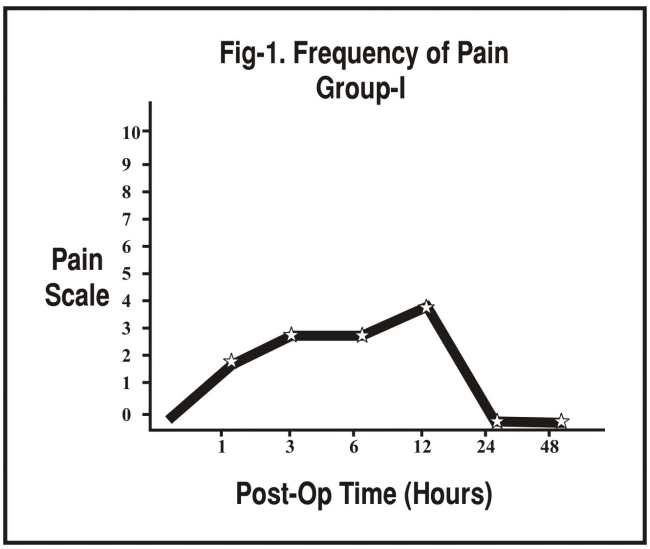
The mean carbon dioxide gas consumption for insufflation

was 38.5 litres and was significantly higher in group B (46.1 litres) than group A (29.9 litres).

SHOULDER TIP PAIN

Patients reporting postoperative shoulder tip pain , present at any point in time during the first 48 hours after operation= 21% (19 of 90 patients).

Right sided shoulder tip pain = 17 patients.
Pain on both sides, moving from one shoulder to the other = 2 patients.



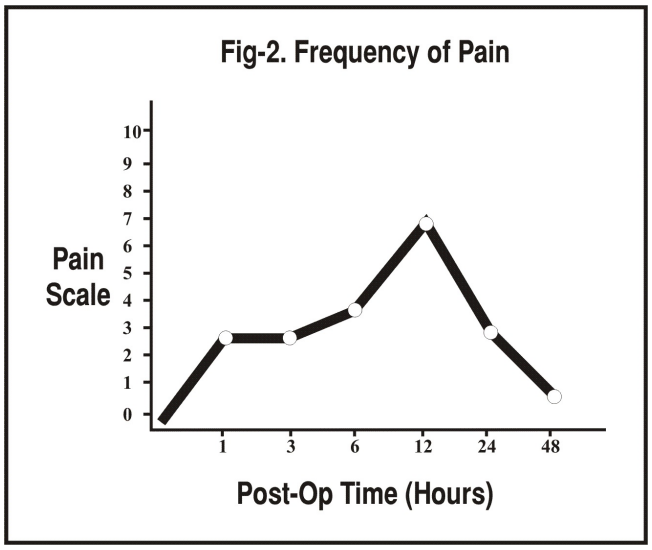
FREQUENCY OF PAIN

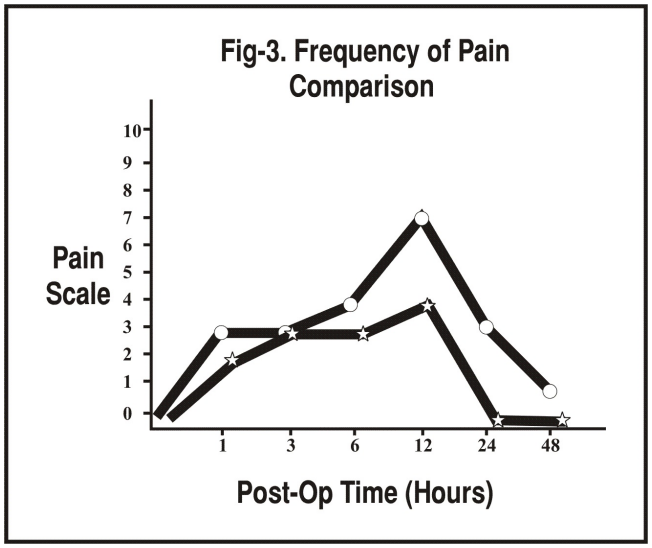
Group A = 5 patients (11%)
Group B = 14 patients (32%)

Shoulder tip pain started at 3-6 h and peaked in both groups at 12 h with significant improvement after this time (Fig 1 & 2). The frequency of shoulder tip pain was significantly lower in group A at 6, 12, 24 and 48 h. Pain scores as recorded on a visual analogue pain scale, revealed that postoperative shoulder tip pain was significantly less intense at 12 and 24 h in the low pressure group A than in group B (Fig 3). Mean shoulder tip pain score approached zero in group A at 24 and 48 hours compared with group B, where the mean intensity of shoulder tip pain exceeded a score of 3 at 24 hours.

ANALGESIC MEDICATION

In both groups there were some patients who did not require any analgesic medication (22 (48%) in group A and 18 (41%) in group B, with no significant differences between the two groups. Mean postoperative intramuscular diclofenac sodium requirements were lower in group A in the 24 h postoperative period (75 versus 150 mg in group B).





Apart from post operative pain, there were no significant intra operative or post operative complications in either group.

There was no correlation between duration of surgery and post operative shoulder tip pain.

DISCUSSION

Postoperative pain at the shoulder following laparoscopic surgery is a frequent and very distressing phenomenon. The aetiology and pathogenesis of this type of pain are still not clearly understood. Some authors maintain that it may be the result of a diaphragmatic irritation of a chemical nature caused by the insufflated carbon dioxide. Carbon dioxide may be transformed by combining with fluid in the peritoneal cavity, to an irritative carbonic acid[6].

This opinion is supported by the observation that, after laparoscopic cholecystectomy, patients experience less pain if nitrous oxide is used instead of carbon dioxide as pneumoperitoneum gas[7]. There are other, however, who believe that shoulder pain after laparoscopy could be caused by over stretching of the diaphragmatic muscle fibres owing to the high rate of insufflation.

In this case, it would be the volume of the gas utilized for the pneumoperitoneum that caused the diaphragmatic irritation. A recent randomized trial demonstrated that the degree of stretching of the intra abdominal cavity is a significant source of post operative pain[8] and it has been shown that a low insufflation rate significantly reduces shoulder pain[9].

Several research studies have been carried out to find ways to reduce the frequency and the intensity of shoulder tip pain. These include ;

1. Different peri-operative analgesic schemes[10-12]
2. Subcutaneous and intramuscular anaesthetic administration to the shoulder[13-14]
3. Intraperitoneal local anaesthetics[15-16]
4. Intraperitoneal normal saline infusion subdiaphragmatically at the end of the operation
5. Heating of carbon dioxide gas to 37°C during laparoscopy

The results of this study demonstrate the effectiveness in reducing post operative shoulder tip pain of an extremely simple intraoperative expedient, the reduction of carbon dioxide pressure, after the introduction of the trocars, from the initial 12-13 mm Hg to 10 mm Hg. Whereas the incidence of shoulder tip pain in the 14 mm Hg pneumoperitoneum group was comparable with values reported in the literature, the incidence in the low pressure group was significantly lower. The intensity of the pain was also lower in patients who underwent laparoscopic cholecystectomy with low pressure pneumoperitoneum.

These data are in agreement with those of other authors who had already found a correlation between intra abdominal carbon dioxide pressure and postoperative pain[23]. They attributed this result to the reduced gas consumption in the low pressure group compared with that in the control group. Also in the present study, the mean carbon dioxide gas consumption for insufflation was significantly lower in the low pressure group and it is hypothesized that the reduced stretching of diaphragmatic peritoneum also helps to minimize shoulder tip pain.

There were no significant complications in either group, and duration of surgery was comparable in the two groups. Operating at a low insufflation pressure means that the insertion of cannulas is more difficult and thus extra care is necessary to avoid injury to intra abdominal structures. In order to reduce the operative risks, it seemed opportune to perform the initial surgical phase, the introduction of the trocars, at a higher pressure (14 mmHg), reducing pressure immediately afterwards.

Although the pain scores differed between the two groups, the number of patients who did not require any analgesic medication was similar for both groups. This lack of a direct correlation may be due to the need for analgesics for pain other than shoulder tip pain in the early post operative period, such as abdominal pain. There is thus a need for further research into ways to improve the quality of the post operative care of these patients. The use of a low carbon dioxide pressure does not compromise the application fo other analgesic methods to reduce the disturbance further.

CONCLUSION

This study demonstrates that use of the simple expedient of reducing the pressure of the pneumoperitoneum to 10 mm Hg

results in a significant reduction in both the intensity of postoperative shoulder tip pain and the frequency with which it is reported. On the basis of these results, the use of low pressure pneumoperitoneum throughout most of a laparoscopic cholecystectomy procedure is recommended.

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