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*C-reactive protein (CRP) as a response to postoperative stress
in laparoscopic cholecystectomy using the abdominal wall lift, with
performed pneumoperitoneum (CO₂), and in open cholecystectomy*

Each operation causes lesser or higher postoperative trauma response. The development of new techniques in surgery allows to reduce the side effects of performed surgery.

In surgery the cholecystectomy ranks next to hernia repair and appendectomy in frequency of abdominal operations performed in the whole world (7). Symptomatic cholelithiasis has traditionally been a surgical disease and, until recently, open cholecystectomy was the gold standard for safety and both short- and long-term efficacy (9). Following recent development of laparoscopic surgical techniques, laparoscopic cholecystectomy has rapidly become the preferred approach. This latter method can be accomplished with excellent cosmetic results and minimal postoperative pain or disability. After laparoscopic cholecystectomy most patients return to full activity or employment within a week. The rapid acceptance of laparoscopic cholecystectomy attests to the revolutionary change it offers in the care of symptomatic cholelithiasis for otherwise healthy patients (5, 2).

The first laparoscopic cholecystectomy was performed by Mauret in Lyon in 1997. In Poland, this operation was carried out in 1991 in Poznań (11). It should be underlined that the alternative to laparoscopic cholecystectomy using pneumoperitoneum is laparoscopic cholecystectomy with abdominal wall lift (1). This latter method eliminates the side effects of pneumoperitoneum and also reduces the postoperative stress of laparoscopic cholecystectomy.

C-reactive protein is an important element of acute phase proteins, whose level of concentration can increase even thousand times during 24 or 48 hours from the onset of stress (8). The increased level of CRP has been observed after the operation and trauma. There is a correlation between the extensiveness of trauma and the observed level of CRP (10). The concentration of CRP after surgery is a very sensitive factor of possible complications and allows to recognize them (10, 12).

The aim of the paper was the comparative study of the postoperative trauma response in laparoscopic cholecystectomy using abdominal wall lift and with performed pneumoperitoneum as well as in open cholecystectomy. This work was undertaken to determine the influence of postoperative stress on the level of C-reactive protein.

MATERIAL AND METHODS

The studies were carried out on 35 patients treated in 1st Department of Surgery and Transplantology, Medical University of Lublin. The population for whom the procedures were available was diagnosed with symptomatic cholelithiasis. All patients were ascribed to group I of risk according to ASA (American Society of Anesthesiologists). This group of patients has used no hormonal preparations, especially no oral contraceptives.

The analyzed patients were randomly divided into three groups: 1) Group I (ChW) – 14 patients (13 women and 1 man) with mean age of 41.7 (29-60) years treated by laparoscopic cholecystectomy with using the abdominal wall lift; 2) Group II (ChL) – 10 patients (8 women and 2 men) with mean age of 40.3 (25-56) years treated by laparoscopic cholecystectomy with using pneumoperitoneum (CO₂); 3) Group III (ChK lub C) – 11 patients (10 women and 1 man) with mean age of 44.8 (29-59) years, in whom open cholecystectomy was undertaken.

Open cholecystectomy was performed in the case of patients after previous abdominal surgery (two cases). This kind of cholecystectomy was also made in patients with indications for duct exploration at the time of open cholecystectomy and also for cholangiography by intraoperative routes (3 patients). All patients were undertaken for premedication, general anesthesia with endotracheal intubation and with controlled ventilation. During early postoperative period all patients obtained Dolargan at the dose of 1mg/1kg of the body weight every six hours.

The laparoscopic cholecystectomy with earlier pneumoperitoneum was performed with the use of three mini "Band-Aid" incisions and next, the closed pneumoperitoneum was done. The laparoscopic cholecystectomy using abdominal wall lift was made by the equipment of Origin Medsystems Inc. Company. In these two types of cholecystectomy the video laparoscopic guidance of Stryker and Auto Suture Company was used. In all cases the drain was left in site of gallbladder removal for 24 hours.

The level of C-reactive protein was estimated three times (before operation, 24 and 72 hours after surgery). In three periods of the experiment, all serum samples from the subject were analyzed and the concentration of CRP was determined using the Unimate 3 CRP no. 0736937 of Hoffman de Roche Company. This method allows to estimate the level of CRP in serum with about 95% sensitivity.

The obtained laboratory results underwent a statistic analysis.

RESULTS

The lesser concentration of C-reactive protein was on the level of 0.5mg/dl. In the described experiment the concentration of CRP smaller than 0.5mg/dl was set on the level of 0.5mg/dl. In all the cases the level of CRP before the surgery was smaller than normal concentration, which was set in this study on the level of 0.9mg/dl.

The observed results of CRP concentration were showed in Table 1 and in Figure 1. In no case the mean concentration measured on the third day was normal. The obtained data allow to say that markedly higher changes of CRP concentration were noted after open cholecystectomy than after laparoscopic cholecystectomy. Furthermore, in the performed two kinds of laparoscopic cholecystectomy the effects of CRP concentration were compared with each other.

Table 1. The concentration of C-reactive protein (CRP) (mg/dl) in 3 experimental groups

| Experimental groups | Statistic analysis | Time of investigation | | | p | | |
|---------------------|--------------------|-----------------------|--------|--------|--------|--------|-----------|
| | | 0 (before) | 24hr | 72hr | 24hr-0 | 72hr-0 | 72hr-24hr |
| ChW | M | 0.54 | 3.8 | 6.35 | p<0.01 | p<0.01 | p<0.01 |
| | SE | 0.02 | 0.55 | 0.7 | | | |
| | V[%] | 16.4 | 54.2 | 41.1 | | | |
| ChL | M | 0.55 | 3.63 | 5.04 | p<0.01 | p<0.01 | - |
| | SE | 0.03 | 0.65 | 1.13 | | | |
| | V[%] | 15.3 | 56.9 | 71.1 | | | |
| ChK | M | 0.56 | 10.91 | 12.06 | p<0.01 | p<0.01 | - |
| | SE | 0.04 | 1.17 | 2.51 | | | |
| | V[%] | 22.5 | 35.6 | 69.1 | | | |
| difference | ChW-ChL | - | - | - | | | |
| between groups | ChW-ChK | - | p<0.01 | p<0.05 | | | |
| (test T-Tukey'a) | ChL-ChK | - | p<0.01 | p<0.05 | | | |

M-median value
SD-standard deviation

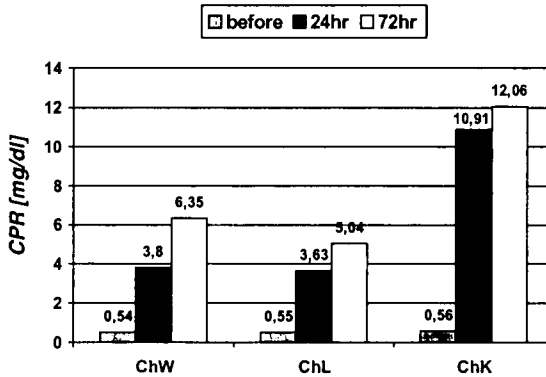


Fig. 1. The dependence between the contretion of C-reactive protein in experimental groups: ChW, ChL and ChK and time of investigation

DISCUSSION

Laparoscopic cholecystectomy was enthusiastically received. It has rapidly become the preferred approach, and has replaced open cholecystectomy. Laparoscopic surgery of cholelithiasis can be accomplished with minimal postoperative pain or disability and with short time of hospitalization and also with excellent cosmetic effects (3). It seems that fast return to health of patients after laparoscopic cholecystectomy can be bound with reduction of postoperative stress. Furthermore, after laparoscopic surgery the hormonal, metabolic and immunological disorders were reduced.

The data from available literature are controversial. Some authors have suggested that minimal difference in metabolic response between laparoscopic and open cholecystectomy could be the result of pneumoperitoneum. It seems that pneumoperitoneum increases the intensity of stress reactions (4). It must also be pointed out that there was a correlation between performed laparoscopic cholecystectomy

with abdominal wall lift and operative trauma. Others underlined the connection between operative stress and both open and laparoscopic cholecystectomy with pneumoperitoneum (10).

In the described above investigation, the patients were qualified to 3 experimental groups. The way of classifying the patients was dependent on the method of performed surgery.

The operative trauma response leads to production and release of many cytokinins and acute phase proteins and also increases the level of stress hormones. In three experimental groups the serum concentration of CRP was measured.

The cholecystectomy caused a marked ($p < 0.01$) increase in the level of CRP concentration in all the patients. The type of cholecystectomy did not influence the observed CRP concentration. The most marked changes were noted in the group of patients who underwent open cholecystectomy. In 24th and 72nd hour after the beginning of surgery the mean level of CRP was 10.91 and 12.06 mg/dl, respectively. These concentrations were markedly higher ($p < 0.01$) than the levels of CRP observed in the patients after laparoscopic cholecystectomy with laparolift (3.80 and 6.35 mg/dl) or with using pneumoperitoneum (3.63 and 5.04 mg/dl).

During the study no statistically significant difference was observed in CRP concentration between groups of patients operated with either of laparoscopic methods. Besides, it was clear that the increased level of CRP concentration between the first and third day after surgery was higher after laparoscopic cholecystectomy with abdominal wall lift. The obtained results were different compared to those of other authors and this fact could arise from the sensitivity of laboratory tests.

Laparoscopic cholecystectomy with performed laparolift eliminates side effects, which are bound with pneumoperitoneum and also with stress and inflammatory reactions (6).

CONCLUSIONS

1. The inflammable response to postoperative trauma is markedly lesser in laparoscopic cholecystectomy than in open cholecystectomy.

2. During the performed study no considerable difference in the inflammable response to postoperative stress in both types of laparoscopic cholecystectomy was observed.

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SUMMARY

The first laparoscopic cholecystectomy was performed thirteen years ago and rapidly became the preferred way of operation in patients suffering from cholelithiasis.

The pneumoperitoneum can be responsible for haemodynamic disorders. The abdominal wall lift is an alternative way for pneumoperitoneum during laparoscopic cholecystectomy.

The aim of this study was the comparative analysis of operative trauma response in the patients treated by laparoscopic cholecystectomy using abdominal wall lift and in cases which underwent open cholecystectomy or laparoscopic operation using pneumoperitoneum.

The concentration of C-reactive protein was measured in patient serum before and twice after surgery. The obtained data underwent a statistic analysis.

In all cases the surgery caused the marked changes of CRP-concentration. The mean level of CRP was higher three times in patients after open cholecystectomy than in cases treated by laparoscopic cholecystectomy with the use of abdominal wall lift or with performed pneumoperitoneum.

During the experiment the statistically significant difference between laparoscopic surgery with the use of the laparolift and laparoscopic with earlier performed pneumoperitoneum was observed. The stress and inflammatory response in cholecystectomy using abdominal wall lift was significant but smaller than the response noted in open cholecystectomy and similar to the response observed after pneumoperitoneum. The replacement of pneumoperitoneum by abdominal wall lift does not change the operative stress in laparoscopic cholecystectomy.

Białko C reaktywne (CRP) jako odpowiedź na uraz operacyjny w cholecystektomii laparoskopowej z zastosowaniem wyciągu powłokowego, odmy otrzewnowej (CO₂) oraz klasycznej cholecystektomii

Zastosowana po raz pierwszy przed 13 laty cholecystektomia laparoskopowa stanowi znaczący postęp w leczeniu kamicy żółciowej. Wytworzenie odmy otrzewnowej niesie za sobą ryzyko zaburzeń hemodynamicznych. Pewną alternatywą dla tej metody jest zastosowanie wyciągu powłokowego w celu zapewnienia dostępu operacyjnego.

Przeprowadzono analizę porównawczą odpowiedzi na uraz w cholecystektomii laparoskopowej z zastosowaniem wyciągu powłokowego w odniesieniu do klasycznej i laparoskopowej

cholecystektomii z wytworzeniem odmy otrzewnowej. Stężenie białka C reaktywnego określano w osoczu krwi przed i dwa razy po operacji. Wyniki poddano analizie statystycznej.

Każda operacja, niezależnie od metody jaką została przeprowadzona, wywołała istotne statystycznie zmiany stężenia badanego parametru. Średnie stężenie CRP po cholecystektomii klasycznej było trzy razy większe niż po cholecystektomii laparoskopowej z wytworzeniem odmy otrzewnowej i po cholecystektomii z zastosowaniem wyciągu powłokowego.

Nie stwierdzono istotnej różnicy między laparoskopią z zastosowaniem „laparoliftu” a laparoskopią „gazową”. Odpowiedź zapalna i stresowa na uraz w cholecystektomii z zastosowaniem wyciągu powłokowego jest znacząca, ale dużo mniejsza niż w cholecystektomii klasycznej oraz podobna do odpowiedzi obserwowanej w cholecystektomii laparoskopowej z wytworzeniem odmy otrzewnowej. Zastąpienie odmy otrzewnowej wyciągiem powłokowym nie zmienia urazu operacyjnego w cholecystektomii laparoskopowej.