

# The Role of Minimum Fluid Requirement Post Laparoscopic Cholecystectomy in Comparison to Open Cholecystectomy

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## ABSTRACT

**Background:** The post-operative management of a patient's fluid balance is one of the most critical aspects of hospital care. Nowadays, many opinions exist as to the best volume of intravenous fluid after elective surgery, as recent studies suggested that a reduction in fluid need after operation to lowest need to reduce complication and postoperative hospital stay. The aim of current study was to evaluate fluid requirement and maintenance in patients after elective laparoscopic cholecystectomy in comparison with elective open cholecystectomy.

**Method:** A prospective study involving cholecystectomized patients at Al- Diwanayah Teaching Hospital for the period from February 2018 to February 2019. Age, sex, body mass index, bowel sound parameters used and selection with aid of American society of anesthesiologists classification also used. Post-operative fluid regime of formula with 10ml/kg of glucose saline was used for the first 8 post-operative hours, with follow up chart. Onset of oral intake and discharge from hospital were discussed and evaluated.

**Results:** Our study included 140 patients who underwent cholecystectomy ; 90 patients with laparoscopic cholecystectomy and 50 patients with open cholecystectomy. The patient's median age was 40 years. There were ninety two females (66%) and forty eight male (34%) patients. In patients with laparoscopic cholecystectomy; 78 patients (87%) needed no further fluid support, resumed oral intake and discharged home within 10-14 hours after operation, whereas 34 patients (68%) of open cholecystectomy were continued on intravenous fluid support. Discharge of all patients with open cholecystectomy was after 24 hours. Statistically, there was highly significant timing change in starting oral feeding in laparoscopic cholecystectomy and timing to start oral intake in comparison with open cholecystectomy, and showed highly significant relation between age of patient and timing needed to start oral intake postoperatively. On the other hand, there was no significant relation between age and time needed to start oral intake postoperatively in open cholecystectomy.

**Conclusions:** Restrict post-operative intravenous fluid for maintenance therapy in elective and uncomplicated laparoscopic cholecystectomy in fit patients in the aim of early discharge of patients from hospital as a day case surgery.

**Keywords:** laparoscopy, cholecystectomy, intravenous fluid, oral intake, postoperative.

## Introduction

The post-operative management of a patient's fluid balance is one of the most critical aspects of hospital care. Nowadays, many opinions exist as to the best volume of intravenous fluid after elective surgery, as recent studies

suggested that a reduction in fluid need after operation to lowest need to reduce complication and postoperative hospital stay <sup>(1)</sup>.

Normally, the optimum physiological change secondary to stimulant factor like operation leads to increase intake of water and sodium, and loss of potassium <sup>(1)</sup>. Open cholecystectomy increases the levels of antidiuretic hormone (ADH), cortisol, aldosterone and catecholamines where they play many physiological changes to maintain osmotic stability <sup>(2)</sup>.

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Minimally-invasive technique that require general anesthesia have a greater physiologic effect because of the anesthesia pneumoperitoneum which may lead to lowering renal blood flow and urine output <sup>(4)</sup>. This decrease in renal blood flow leads to increasing sodium retention. Pneumoperitoneum also leads to increase ADH <sup>(5)</sup>. Also, insensible fluid loss in open cholecystectomy is absent during laparoscopic operation.

**Regulation of total body water:** If water loss exceeds gain, a reduction in total body water content and the osmolality of body fluid increase. This has two effects; Thirst, with consequent ingestion of water and Release of ADH so that water is retained by the kidneys. Other mechanisms are available for stimulation of thirst and ADH release, these include:

1. Reduced arterial blood pressure (signals via carotid and aortic baroreceptors),
2. Reduced central venous pressure (signals via atrial low pressure receptors) and
3. Increase angiotensin II in the brain. These mechanisms reflected by change in pulse rate and blood pressure, both can be used for patient's monitoring <sup>(7)</sup>.

The aim of current study was to evaluate fluid requirement and maintenance in patients after elective laparoscopic cholecystectomy in comparison with elective open cholecystectomy.

The objectives of current study were

1. to sharpen the effect of restriction of post-operative intravenous fluid in laparoscopic cholecystectomy on discharge of patients from hospital as a day case surgery,
2. To study the influence of application of this regimen to different age groups and sex, and
3. To make the results of the study available to the health authority in order to improve the services required to deal with this condition.

### **Patients and Method**

It's prospective, comparative study performed at Al-Diwaniyah Teaching hospital for the period between February 2018 and February 2019. The study included 140 patients presented with symptomatic chronic cholelithiasis, proved by clinical examination and ultra-sonic evaluation, were prepared for elective

cholecystectomy. The decision for the type of operation (open or laparoscopic cholecystectomy) was determined according to surgeon's recommendation, anesthetic opinion and patient's preference. Patients who had ASA grade 3 or more and those with laparoscopic operation converted to open cholecystectomy were excluded from the study. Patients were entered to the hospital one day before surgery and an informed consent was taken. All patients were fasting for eight hours for solid food and 4 hours for fluid before surgery. Patients received a single prophylactic dose of ceftriaxone 1gm intravenously at the induction of anesthesia. No intravenous fluids were received before operation. The operation was done under general anesthesia. Post-operatively, all patients received 10mL/kg of intravenous glucose saline (5% dextrose with 0.45 NaCl) infused over 8 hours through a peripheral intravenous line. Patients were also given paracetamol vial (1000mg/100ml) every eight hours. A follow up chart that included pulse rate, blood pressure and bowel sounds to be assessed every two hours together with absence or presence of vomiting.

These parameters were collected and registered in a special formula together with patient's body parameters (body weight, height and body mass index) . Comparison was made between the two groups (open vs. laparoscopic) regarding the aforementioned parameters after 8 hours and the ability to resume oral intake was assessed depending on the return of bowel sounds and the absence of vomiting as well as hemodynamic stability. All patients were advised to mobilize 6 hours post operation.

Data were presented as numbers and percentages. Comparisons were made using Chi-squared test and level of significance was considered at P value  $\leq 0.05$ .

### **Results**

Our study included 140 patients who underwent cholecystectomy at AL-Diwaniyah Teaching Hospital, 90 patients with laparoscopic cholecystectomy and 50 patients with open cholecystectomy. Patients' age varied from 20 to 60 years with an average of 40 years. In addition, ninety two were females (66%) and forty eight were males (34%).

Assessment of patients who underwent laparoscopic cholecystectomy revealed that 78 patients (87%) were hemodynamically stable, had audible bowel sounds and got no vomiting at the end of the first 8 hour



postoperatively. Therefore, those patients required no further fluid support and they resumed oral intake. They were discharged home within 10–14 hours after operation and given an appointment for further surgical follow-up.

On the other hand, 12 patients (13%) did not resume bowel activity, had vomiting or showed unstable hemodynamic state, they were not allowed to resume oral intake, kept on intravenous fluid and their discharge from hospital was delayed until stabilization and resumption of oral intake.

Sixteen of patients (32%) with open cholecystectomy could start oral intake after the first 8 hours, whereas

34 patients (68%) were continued on intravenous fluid support as they had vomiting, absent bowel sounds, or hemodynamic instability. Discharge of all patients with open cholecystectomy was after 24 hours. Those who started oral intake were discharged next morning; others were kept in hospital till resumption of oral intake and discharged within 24–28 after operation.

Statistical studies showed highly significant relation between laparoscopic cholecystectomy and time needed for starting oral intake ( $X^2 = 13.8$ ;  $P$ -value  $< 0.001$  at 99.9 confidence interval) in comparison with open cholecystectomy as shown in Table (1).

**Table 1: Numbers and percentages of patients with laparoscopic cholecystectomy and open cholecystectomy who started oral intake**

Time of starting oral intake (stop intravenous fluid)	Laparoscopic cholecystectomy No.(%)	Open cholecystectomy No.(%)
Eight hours or less	78(87%)	16(32%)
More than eight hours	12(13%)	34(68%)
Total	90(100%)	50(100%)

The relation between age of patients and resuming oral fluid intake was shown in Table (2). For those with laparoscopic cholecystectomy it showed highly significant relation between age of patient and time needed to start oral intake postoperatively in laparoscopic cholecystectomy ( $X^2= 12.7$ ;  $P$ -value  $< 0.001$  at 99% confidence interval). On the other hand, Table (3) showed the relation of age of patients and resuming oral fluid intake for those with open cholecystectomy. Statistical analyses showed no significant relation between age and time needed to start oral intake postoperatively in open cholecystectomy ( $X^2= 1.7$ ;  $P$ -value  $> 0.005$  at 95% confidence interval).

**Table 2: Numbers and percentages of patients who started oral intake in relation to their age in laparoscopic cholecystectomy**

Time of starting oral intake (stop intravenous fluid)	Age of patients/yr			
	20 - 30	30 - 40	40 - 50	50 - 60
Eight hours or less	28(93%)	32(91%)	12(80%)	6(60%)
More than eight hours	2(7%)	3(9%)	3(20%)	4(40%)
Total	30	35	15	10

**Table 3: Numbers and percentages of patients who started oral intake in relation to their age in open cholecystectomy**

Time of starting oral intake (stop intravenous fluid)	Age of patients/yr			
	20 - 30	30 - 40	40 - 50	50 - 60
Eight hours or less	5(45%)	4(40%)	4(28%)	3(20%)
More than eight hours	6(55%)	6(60%)	10(72%)	12(80%)
Total	11	10	14	15

## Discussion

The aim of postoperative fluid is maintaining normal functional volume indicated by optimum recovery<sup>(10)</sup>. As known that both fluid overload and underload should be avoided, the suitable volumes needed to achieve euovolemic status have not been decided yet<sup>(10)</sup>. A previous study<sup>(13)</sup> found that excessive post-operative fluid administration is a recognized most important cause of postoperative morbidity, prolonged hospital stay, organ failure and mortality. The level of surgical stress is related directly to the degree of surgical trauma<sup>(14)</sup>. This means that, in euovolemic post-operative patient, the target is to allow wise net excretion of excess salt and water until the patient has returned their sodium and fluid balance. So, the fluid volume should be for daily maintenance and replacement of any on-going additional losses, and postoperative fluid regime should be considered in relation to current balance due to previous fluid treatment (pre- and intra-operatively) which really affects post-operative state of the patient<sup>(15)</sup>. Previous studies reported an early return back to daily activity when fluid intake is restricted post-operatively<sup>(16-18)</sup>.

In our study we used the simplest formula of post-operative fluid supply in uncomplicated elective cholecystectomy patients, and we found that laparoscopic cholecystectomy patients can reassume oral fluid early post operatively with minimum intravenous fluid and discharged on the same day of surgery without ill effects, those within younger age group were more rapidly regained their homeostasis and were ready to start oral fluid early, which reflected that less trauma was induced by laparoscopic cholecystectomy. These data were in agreement with other studies<sup>(16,19)</sup>. The sex of patients showed no effect on amount of post-operative fluid needed in both types of operations. Regarding open cholecystectomy, patients did not respond well to restrictive intravenous fluid and most of them needed further follow up till they could start their bowel activity, which indicated more trauma induced by open cholecystectomy and more fluid loss in this type of operation.

Our regimen was to use glucose saline in the post-operative period for uncomplicated cholecystectomy as it is devoid from potassium, contains less amount of sodium and can maintain fluid requirements.

The surgical stress causes an impairment in gastrointestinal motility<sup>(26,27)</sup>, which may theoretically be increased both by decrease of fluid in the body and

fluid overload (as decreased motility secondary to fluid accumulation in the bowel wall and surrounding tissue)<sup>(28)</sup>, which may lead to post-operative nausea and vomiting as well as the effect of anesthetic drugs and type of cholecystectomy procedure<sup>(29)</sup>. Other studies concluded that post-operative pain, vomiting and nausea have been found to influence post-operative fluid administration<sup>(30)</sup> and to potentially predict hospital stay after surgery<sup>(31)</sup>.

It is proved that post-operative pain is less severe after laparoscopic cholecystectomy, so needs less post-operative pain killers than open cholecystectomy<sup>(32)</sup>, this was reflected in our patients by early return of bowel activity, cardiovascular stability and early discharge from hospital.

Absence of complications, stable homeostasis, positive bowel movement, mobility and toleration of a general diet are considered criteria for early discharge by most (including us) of surgical opinions<sup>(33)</sup>.

We recommend further studies about the effect of intra-operative fluid regimen on the amount of post-operative fluid in elective cholecystectomy.

## Conclusions

Restrict post-operative intravenous fluid for maintenance therapy in elective and uncomplicated laparoscopic cholecystectomy in fit patients in the aim of early discharge of patients from hospital as a day case surgery.

**Ethical Clearance:** The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

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