INTRAVENOUS ATROPINE IN LAPAROSCOPIC CHOLECYSTECTOMY: IS IT SIGNIFICANT?

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Abstract

Bradycardia is a known problem in laparoscopic cholecystectomy especially during pneumoperitoneum and gall bladder dissection which might necessitate the use of intravenous atropine. The clinical significance of the latter as prophylactic issue in laparoscopic cholecystectomy has not been studied much to clarify its importance and to know how and when it could be used. We conducted a prospective study to evaluate the significance of preoperative intravenous atropine sulphate to reduce bradycardia during laparoscopic cholecystectomy.

One hundred and forty patients were analyzed in a prospective study; seventy of them were atropine group and another seventy were non atropine group. Heart rate changes were studied in both groups in respect to preoperative, pneumoperitoneum and postoperative period. As well as the heart rate changes were evaluated separately in each group in concern of preoperative and pneumoperitoneum period.

The results showed that age, sex, body mass index, duration of surgery and previous operations were comparable in both groups. Significant bradycardia was seen in non-atropine group during pneumoperitoneum as compared to atropine group (p<0.05), while insignificant heart rate changes were observed in both groups across preoperative and postoperative period (p>0.05).

In conclusion, this work shows that a preoperative intravenous dose of atropine sulphate might be of value in preventing bradycardia during laparoscopic cholecystectomy.

Introduction

The emergence of laparoscopic surgery has changed the way of approach for several organs. In the treatment of diseases like symptomatic cholelithiasis, the laparoscopic approach has virtually replaced the open abdomen approach, with the latter being employed only if the former fails. The laparoscopic approach has several advantages over the conventional approach. These include reduction of postoperative pain, better cosmetic results, quicker return to normal activities, reduction in hospital stay resulting in overall reduction in total cost of treatment, less intra-operative bleeding, less postoperative wound infection, reduced metabolic derangement and better postoperative pulmonary function[1-3].

Despite these advantages, laparoscopic surgery may result in serious complications due to the important physiologic changes which occur during the procedure. In complicated surgical cases of extended duration, the prolonged steep head-down position and carbon dioxide insufflations results in a pneumoperitoneum which have adverse hemodynamic and respiratory consequences. Negative aspects of laparoscopic surgery in terms of the surgical procedure itself include poor visualization and traumatic injuries to viscera and blood vessels associated with blind trocar insertion[4]. Little is known about the incidence of bradyarrhythmia during laparoscopic

cholecystectomy in particular among low risky patients despite much debate in the literature regarding the efficacy of routine atropine administration before induction of anesthesia in laparoscopic cholecystectomy[5].

The physiologic changes associated with laparoscopy include those associated with tilting the patient to facilitate instrumentation and surgical exposure, the pressure effects of instilled gas into a closed cavity, and the systemic effects of the gas, almost universally CO_2, that is instilled and absorbed or embolized[4]. However pneumoperitoneum required for this procedure affects several systems leading to alterations in cardiovascular, respiratory, stress response and acid base physiology[4].

In abdominal laparoscopy procedures, hemodynamic and respiratory alterations are both derived from the same three origins: the first one is the intra-abdominal pressure created by the pneumo-peritoneum; the second one is the existence of an insufflation gas that is absorbed by the blood; the third one is the Trendelemburg or reverse Trendelemburg positioning of the patient[6].

The nature of changes in cardiovascular system associated with pneumo-peritoneum includes an increase in mean arterial pressure, decrease in cardiac output and increase in systemic vascular resistance which can lead to altered tissue perfusion. These changes though better tolerated in ASA I and II patients can be detrimental in elderly and ASA III patients particularly with compromised cardiovascular system physiology[7].

Conditions leading to development of arrhythmias are CO_2 insufflations, hypercapnea, increased vagal tone owing to traction on the pelvic or peritoneal structures, Trendelenburg position, anesthetic drugs (especially, halothane in combination with spontaneous ventilation), preoperative patient's anxiety, endobronchial intubation, and gas embolism[7,8].

Symptomatic bradycardia, defined as a heart rate less than 60 with signs and symptoms of poor perfusion caused by the slow heart rate. These signs and symptoms include acute altered mental status, ongoing chest pain, shortness of breath, hypotension, or other signs of shock[9]. Bradcardia may occur during anaesthesia from many causes, including cardiac pathology, anesthetic drugs and hypoxia. Sudden bradycardia may also be produced through 'paradoxical' cardio-vascular reflexes[10]. These are activated especially during periods of reduced venous return to the heart, over-riding the effect of baroreflex suppression which acts to maintain blood pressure in this situation by increasing heart rate and vasoconstriction[10].

Various surgical methods like change in nature of insufflating gas[11] use of low intra-abdominal pressure[12,13] and use of abdominal wall lift methods[14], have been tried to decrease the hemodynamic alterations seen with pneumoperitoneum, but all with practical limitations. Various anesthetic interventions like use of epidural, segmental spinal[15], combined epidural and general anaesthesia[16], use of various pharmacologic interventions like nitroglycerine[17], esmolol[18], magnesium sulphate[19] have been used with varying success and practical limitations.

The anesthesiologist must have a deep understanding of the pathophysiological consequences derived from pneumoperi-toneum, to be prepared to prevent, detect and address the possible alterations that can occur during the intervention.

Excessive vagal activity which causes severe bradycardia and hypotension can be life threatening[8]. Prompt treatment is needed with the use of anticholinergic and sympathomimetic drugs[20,21].

There are studies addressing administration of anticholinergic agents, especially glycopyrrolate and atropine, for prevention of bradycardia during open surgeries in children and adults[22,23].

Such studies have also been done for gynecologic laparoscopic surgeries[24] however, there are limited data on the efficacy of these drugs during laparoscopic cholecystectomy. The aim of this study is to evaluate the significance of preoperative intravenous atropine sulphate to reduce bradycardia during laparoscopic cholecystectomy.

Patients and Methods

This prospective randomized clinical double-blind study was carried out in Basrah General Hospital, Department of Surgery between July 2012 and February 2014 for patients with symptomatic cholelithiasis. Patient demographics, past history, recent history, drug history and accompanying systemic diseases were evaluated. All patients signed informed consent.

Patient's age ranged between 15 and 50 years old who were candidates for elective laparoscopic cholecystectomy. All of the patients were in the American Society of Anesthesiologists' categories I and II and did not have any history of cardiac disease.

The exclusion criteria were history of cardiac arrhythmias (such as sick sinus syndrome), drug-induced bradycardia, a history of cardiovascular, respiratory, renal or hepatic disease as well as contraindication of general anesthesia, laparoscopic surgery or atropine sulphate.

Patients were randomly divided into two groups. Randomization was determined by electronic program to be with or without atropine administration. In group I, the anesthesiologist gave 0.6 mg atropine sulphate intravenously three to five minutes before induction of anesthesia while in group II no pre induction atropine administration was given.

During period of the study, one hundred and forty patients were scheduled for laparoscopic cholecystectomy and enrolled in the study which were categorized into two groups; Group I (seventy patients) which comprised those received atropine while group II (seventy patients) comprised those who did not received atropine.

The normal adult human heart rate ranges from 60–100 beats per minute (bpm). Bradycardia is a slow heart rate, defined as below 60 bpm. Tachycardia is a fast heart rate, defined as above 100 bpm at rest. When the heart is not beating in a regular pattern, this is referred to as an arrhythmia. These abnormalities of heart rate sometimes, but not always, indicate disease[25].

All patients received one gram ceftriaxone intravenously at the induction of anesthesia and some received four thousands unit low molecular weight heparin (LMW heparin) given two hours before the operation.

One anesthesiologist was responsible for the general anesthesia, using endotracheal intubation and a standard anesthetic technique.

The patients were secured slightly head up in the supine or right up position, and their intra-abdominal pressure was maintained below 12 mm Hg during the operation, they were monitored with a non-invasive arterial pressure measurement device, electrocardiography (ECG), pulse oximetry, and capnography.

Controlled ventilation was used throughout to maintain eucapnia. Heart rate, blood pressure and ECG changes as brady-or tachyarrthmia were recorded as following in all of the patients: (1) Before induction of anestheisa (2)During pneumoperitoneum and gall bladder dissection. (3) Postoperative in recovery room.

If arrhythmia or bradycardia developed, it would be controlled by atropine sulfate or other anti-arrhythmic drugs.

Laparoscopic cholecystectomy was performed using the standard four-port technique advocated by Reddick[26].

Data were analyzed using SPSS 15.0 software, with the chi-square test, unpaired t-test and Mann-Whitney test, as

appropriate; p<0.05 was considered to be statistically significant.

Results

A total of one hundred and forty patients (n=140) entered the study and those were divided into atropine group (n=70) and non-atropine group (n=70) group. There was no significant difference between these groups of patients with respect to age, sex, body mass index (BMI), duration of surgery and previous operations as shown in Table I. The difference is statistically not significant (P>0.05). Bradycardia was insignificantly seen between atropine and non atropine group during preoperative and postoperative period (92.2vs90.1/87.4vs90.7) respectively as shown in Table II. The difference is statistically not significant (P>0.05), while in a period of pneumoperitoneum period with gall bladder dissection which revealed significant relation between both groups (102.3vs66.1) for atropine and non atropine group respectively (Table II). The difference is statistically significant (P<0.05). Regarding atropine group, non-significant changes in heart rates were observed during preoperative and pneumoperitoneum period (92.2vs102.3) respectively as shown in Table III. The difference is statistically not significant (P>0.05). In non-atropine group, significant relation was seen as observed in bradycardia which was seen much more during pneumoperitoneum period than preoperative period. (66.1vs90.1) respectively as shown in Table III. The difference is statistically significant (P< 0.05).

Table I: General criteria of both groups

	Atropine	Non-Atropine	P value
Sex M/F	7 /63	9/61	>0.05
Age (years) Mean (S.D)	16 – 63 43(17.1)	17 – 59 41.6(16.8)	>0.05
Body Mass Index (BMI) Mean (S.D)	25.8 (9.1)	26.4 (8.9)	>0.05
Previous laparotomy	13/57	16 /54	>0.05
Duration of surgery(minutes) Mean	18 -70 36.7	16 -75 37.4	>0.05

The P value by Pearson Chi-Square is >0.05, the differences between two groups are insignificant. "S.D = Standard deviation"

Table II: Incidence of bradycardia in atropine and non–atropine groups

	Atropine group Mean (S.D)	Non-Atropine group Mean (S.D)	Total
Preoperative	92.2 (12.8)	90.1 (13.3)	>0.05
Pneumoperitoneum	102.3 (9.1)	66.1 (15.2)	< 0.05
Postoperative	87.4 (11.6)	90.7 (11.2)	>0.05

Table III: Heart rate changes in preoperative and pneumoperitoneum period of both groups

	Preoperative Mean (S.D)	Pneumoperitoneum Mean (S.D)	P value
Atropine group	92.2 (12.8)	102.3 (9.1)	>0.05
Non-Atropine group	90.1 (13.3)	66.1 (15.2)	<0.05

Discussion

Pneumoperitoneum, using carbon dioxide (CO_2), is of value in laparoscopic surgery to make distension of abdominal cavity and splitting up its content, which improves visualization. However, bradycardia and even cardiac arrest, which are originated from increased abdominal pressure and CO_2 retention which are of importance to notice in merit of assessment for preventive and treatment issue[27].

The present study revealed significant effect of intravenous atropine sulfate on prevention cardiac arrhythmias (sinus bradycardia) during pneumoperitoneum and gall bladder dissection for laparoscopic cholecystectomy.

Anticholinergic agents alter the balance between sympathetic and parasympathetic activity in the autonomic nervous system by blocking the parasympathetic muscarinic receptors[23,24]. This resembled a study of Aghamohammadi et al[28] in evaluating the prophylactic effect of atropine during laparoscopic urological procedures in adult.

In a study by Annila and colleagues[20] that evaluated intravenous atropine sulfate and glycopyrrolate on cardiac arrhythmias for adenoidectomy in children, the use of anticholinergics did not influence the incidence of ventricular arrhythmias during anesthesia with halothane in children. Bradycardia was more common in the placebo group than in the atropine group. Although patients were young and the procedure was not laparoscopic, bradycardia was more common in the placebo Group (non-atropine), which is similar to our results.

In current study, the bradycardia is obviously seen significantly in non-atropine group during pneumoperitoneum and Gall bladder dissection as compared to preoperative period. Moreover, the heart rate changes across these two periods were not significant in atropine group.

Bradycardia was more common in patients receiving no medication before the procedure than in those who received atropine sulfate. However, even in those with no atropine, the events were short and resolved after treatment with atropine or spontaneously after desufflation or cessation of painful stimulants.

Clinical awareness of this heart rate changes during laparoscopic cholecystectomy is so important as it may worsen rapidly if not noticed earlier and managed promptly as well as it is potentially preventable and treatable condition carrying excellent prognosis if prevented, diagnosed early and treated properly.

Conclusion

Our work shows that a preoperative intravenous dose of atropine sulphate might be of value in preventing bradycardia during laparoscopic cholecystectomy.

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