

In the name of God



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## **Disseminated Intraabdominal Heat Injury in a Case of Laparoscopic Cholecystectomy.**

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### **Abstract:**

A 38 yr-old man was scheduled for laparoscopic cholecystectomy. General anesthesia was selected and induced. About 40 minutes after initiation of laparoscopic surgery a progressive tachycardia and hypertension was noticed. We checked anesthetic machine, O<sub>2</sub>, inhalational anesthetics and appropriate position of tracheal tube. Then narcotic and muscle relaxant repeated but our efforts were ineffective. The operation ceased and when laparoscope was withdrawing it accidentally touched the anesthesiologist's hand. It was unexpectedly hot and heat injury supposed. The abdomen was opened immediately. Intraabdominal temperature was abnormally high and visceral organs were reddish and inflamed. After rapid irrigation of abdomen with cold normal saline, tachycardia and hypertension regressed to normal situation and open cholecystectomy was down.

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Key Words: heat injury, laparoscopic cholecystectomy, electrocautery.

## Introduction:

In the late 1980s after the first successful laparoscopic cholecystectomy in Europe, this revolutionary minimally invasive surgery rapidly became the accepted technique for the treatment of symptomatic gallbladder disease (eg, due to cholecystitis or recurrent gallstones) in the United States. The rapid acceptance of this new technique by the medical profession and the public was related to the obvious advantages of reduced cost, decreased hospital length of stay, and increased patient satisfaction<sup>(9)</sup>.

But sometimes limited field of view and usage of monopolar electrocautery system can cause injuries unique for laparoscopic surgery such as in this case report.

## Case Presentation:

This case involves a 38 years old man with 75 kg weight, 170 cm height and ASA class I, who was scheduled for elective laparoscopic cholecystectomy. Past medical history, physical examination, and routine tests were unremarkable. He had no history of anesthesia or surgical procedure.

General anesthesia was planned. Vital signs before induction of anesthesia were blood pressure (BP) =110/70mmhg and heart rate (HR) = 75 beats/min.

He was monitored by noninvasive blood pressure), pulse oximeter and capnograph. After injection of midazolam 2 mg and fentanyl 150 ug as premedication, general anesthesia was induced with thiopental 300mg and atracurium 40 mg. Anesthesia was maintained by N2O-O2, isoflurane and

fentanyl every 20 minutes. Vital signs which recorded after tracheal intubation were BP=100/70mmhg and HR= 80 beats/min.

Approximately 40 minutes after initiation of operation and CO2 insufflations began to increase. We checked anesthetic machine, anesthetic gasses and position of tracheal tube. Fentanyl 100ug and atracurium 10 mg were injected but tachycardia and hypertension were progressive.

During 5 minutes HR increased up to 150 beats/min and blood pressure rose to 150/80 mmhg. Then he developed dysrhythmia and perspiration. Axillary temperature was normal. Capnograph showed mild increase in EtPco2. Because of critical condition of the patient, operation was terminated temporarily.

After withdrawing of laparoscope it became in close contact with anesthesiologist's hand accidentally. It was very hot and we supposed an intra-abdominal heat injury. Immediately the abdomen was opened. Intra-abdominal temperature was unexpectedly high. Bowels and visceral organs were red, inflamed and a disseminated injury was apparently seen. Immediately abdominal cavity was irrigated with cold normal saline; irrigation was continued until complete regression of redness and inflammation. Tachycardia, hypertension and dysrhythmia disappeared and vital signs returned to normal. Then an open cholecystectomy was performed. At the end of surgery the patient was completely stable and he was eventually dis-

charged from the hospital at the 7th post-operative day.

### Discussion:

Several reports in the literature document major complications during laparoscopic surgery that were the result of either pneumoperitoneum or insufflating gas <sup>(1-8)</sup>. The first documented case of intraabdominal explosion was a nonfatal event that occurred in 1933, when Ferver used 100% oxygen as insufflating gas <sup>(1)</sup>. The use of CO<sub>2</sub> has been associated with both fatal and nonfatal injuries sustained during laparoscopic surgery <sup>(1,4,6)</sup>. Nitrous oxide has been implicated in several intraabdominal explosions described in 1970s <sup>(4,7)</sup>.

Current surgical practice is to use 100% CO<sub>2</sub>, because it is noncombustible and thus will not create an explosion should the electrocautery generate a spark or ignite bowel gas (Methan/Hydrogen)<sup>(8)</sup>. Diagnostic endoscopists prefer nitrous oxide because it is better tolerated (less peritoneal irritation) in their awake patients and because they do not use electrocautery <sup>(1)</sup>. An intraabdominal fire during laparoscopy has been reported in 1995. It was because of the incidental use of a mixture of 14% CO<sub>2</sub> and 86% O<sub>2</sub> instead of pure CO<sub>2</sub> <sup>(1)</sup>.

Other probable causes have been suggested to create intra-abdominal heat injuries:

The heat at the distal end of laparoscope light is clearly sufficient to ignite flammable materials in close proximity to it <sup>(2)</sup>. Thus prolongation of surgery can cause an increased temperature in a restricted space

such as abdominal cavity. On the other hand electro-coagulation can create serious burns.

In addition to direct burn by the cautery needle, smoke associated with electro-cautery may allow sparking and its attendant damage to nearby bowel wall. Such damage is unlikely to occur during open laparotomy for several reasons. During open laparotomy the bowel is well protected by laparotomy pads, smoke readily dissipate to the well ventilated room and any bowel adjacent to the burnt area can be inspected to assure that no damage has occurred. In contrast, in laparoscopic surgery, the bowel cannot be protected, and bowel inspection is insufficient due to the limited field of view offered by the camera <sup>(9)</sup>.

Electro-coagulation using high frequency (HF) current may be monopolar or bipolar. Bipolar is safer in dissections where space is restricted (such as in laparoscopic surgery). When a monopolar system is used the safest form is soft coagulation. This setting maintains the voltage below 200V so that sparks are not generated. Soft coagulation is recommended for endoscopic use. It may be applied by insulated graspers, hook, spatula or scissors <sup>(10)</sup>. In the presence of electricity leak and HF monopolar electrocautery, irrigation solution (saline normal) which is used in laparoscopic surgery can act as a conductor of electricity. Passage of electrical current through the irrigation solution and other intra-abdominal fluids can lead to an increase in temperature of fluid. Then disse-

minated heat burn will be probable in organs which are in close contact with hot fluid. We suppose leak of electrical current, HF monopolar electrocautery and restricted space of abdomen were responsible for heat injury in this case report.

There are three ways by which electrical current can leak into undesirable situations and serious thermal injury <sup>(10)</sup>:  
*Direct coupling:* This occurs when the diathermy is activated and the active electrode is near a metal instrument. The second instrument becomes energized. This energy will seek a pathway and complete the circuit with the patient electrode. Neighboring organs can become injured.

*Insulation failure:* Faulty instruments cause this. Insulation "breaks" in cable can cause "leaks". This is more common when high voltage coagulation current is used.

*Capacitance coupling:* When a non-conductor of electricity separates two conductors, capacitance appears. This typically occurs between an insulated instrument and a metal cannula. An electrostatic current field is created and it can induce current in the metal cannula. Plastic cannula does not eliminate this problem completely as the patient's body can act as a conductor. The worst situation occurs when a reducer is used in a plastic cannula.

**Safety Considerations in Minimal access surgery:**

- DO NOT ACTIVATE THE GENERATOR WHILE THE ACTIVE ELECTRODE IS TOUCHING OR IN CLOSE PROXIMITY TO ANOTHER METAL OBJECT.

- ALWAYS CHECK INSTRUMENTS FOR INSULATION BREAKS. MINIMIZE THIS DANGER BY KEEPING THE COAGULATION CURRENT SETTING TO BELOW 200V.
- USE ALL METAL CANNULA SYSTEMS. INVEST IN LATEST TECHNOLOGY-RECENT DIATHERMY MACHINE WHICH COME WITH ACTIVE ELECTRODE MONITORING, WHEREIN EXCESS STRAY CURRENT AUTOMATICALLY SWITCHES THE GENERATOR OFF.
- BIPOLAR SYSTEM IS SAFER THAN MONOPOLAR IN ENDOSCOPIC SURGERY.

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