

Title: ABDOMINAL WALL TENSION DECREASES WITH TIME DESPITE CONSTANT LEVELS OF NEUROMUSCULAR BLOCKADE

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Introduction. To facilitate surgical exposure in patients undergoing intrabdominal surgery, anesthesiologists routinely attempt to minimize abdominal wall tension (AWT). Neuromuscular blockade and potent inhalational anesthetic agents are commonly employed for this purpose. Previous studies have attempted to delineate the relative contribution of neuromuscular blockade⁽¹⁾ and potent inhalational anesthetics⁽²⁾ to measured AWT. This study was undertaken to determine whether AWT changes with time independent of changes in anesthetic technique; accordingly, we measured AWT at two intervals during an anesthetic protocol in which potent inhalational agents were not employed and in which neuromuscular blockade was maintained at constant levels during intrabdominal surgery.

Methods. With institutional approval, we studied 10 non-obese patients (21-69 yrs, all P51 and 2) having abdominal surgery with midline incision done by a single staff surgeon. Following induction of anesthesia with thiopental (1.8-4.5 mg/kg), fentanyl (3.1-6.8 ug/kg), and 60% nitrous oxide in oxygen, a train of four supramaximal 0.1 msec impulses over the ulnar nerve every 20 sec produced an evoked hypothermic electromyogram which was integrated and continually displayed*. An intravenous bolus of atracurium adequate for intubation produced moderate levels of neuromuscular blockade (integrated electromyogram first twitch, T₁, mean 13% ± 2% (+ SE) of unparalyzed control) which were then maintained empirically by continuous atracurium infusion (2.9-6.0 ug/kg/min).

A sterile Balfour retractor with amplified, electrically-isolated strain gauges was locked into position in the abdominal incision at the fixed displacement needed for optimal surgical exposure. An initial measurement of AWT was then obtained in an undisturbed field. A second AWT measurement was obtained 40-70 minutes after the first measurement, again in an undisturbed field. All pairs of consecutive measurements (T₁, AWT atracurium) were compared using Wilcoxon's signed rank test for paired samples, p < 0.05 significant.

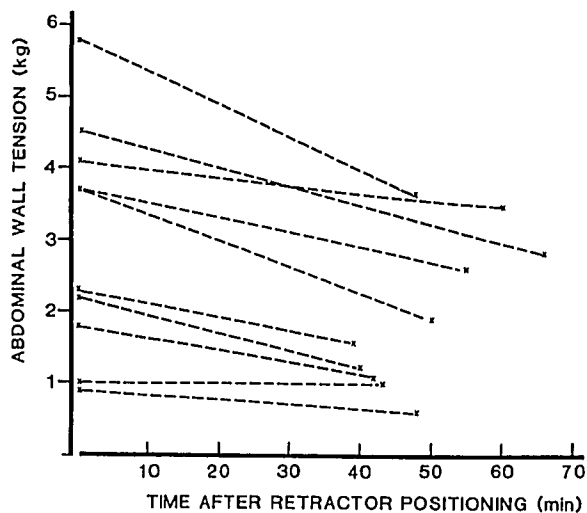
Results. AWT was significantly less (p < 0.01) 40-70 minutes after retractor positioning and initial AWT measurement (Figure), even though neuromuscular blockade was maintained constant by titration of the atracurium infusion (table). Mean reduction of AWT over time was 1.0 ± 0.2 Kg (+SE), an average change -32 ± 5% of initial AWT.

Discussion. Our results indicate that AWT decreases over time by a mechanism other than changes in the level of neuromuscular blockade. Stretching and fatigue of the noncontractile elements within the abdominal wall or in the viscera could reduce AWT without altering indicated neuromuscular blockade. Although we did not measure compliance of the respiratory diaphragm, ventilator parameters were constant and CO₂ did not change significantly. We conclude that while the quantitative contributions of

visceral distension, diaphragmatic tone, and neuromuscular blockade to AWT remain to be determined, AWT decreases with time, thus facilitating surgical exposure independent of changes in the level of neuromuscular blockade. This time related decrease in AWT must be taken into account both when planning the conduct of an anesthetic and when attempting to determine the factors which contribute to AWT during intrabdominal surgery.

TABLE. MEAN DATA ± SE

	1st Measurement	2nd Measurement
AWT(Kg)	3.0 ± 0.5	1.1 ± 0.3
T ₁ (% control)	13 ± 2	13 ± 1
Atracurium(ug/kg/min)	4.6 ± 0.3	4.7 ± 0.8
Endtidal(CO ₂ /mmHg)	32 ± 1	30 ± 1
Temperature (°C)	35.5 ± 0.2	35.3 ± 0.2
Min. from induction	58 ± 4	107 ± 5



References:

1. Weber S, Muravchick S, DeFeo SP, et al. Correlation of evoked twitch response to abdominal wall tension during surgery. Anesthesiology 63: A325, 1985.
2. Ensalada LM, Muravchick S, Weber S, et al. Isoflurane reduces abdominal wall tension independent of its effect on neuromuscular blockade. Anesthesiology 65:A350, 1986.

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