

Title: HEMODYNAMIC AND HORMONAL CHANGES ASSOCIATED WITH ESWL

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**Introduction.** Patients undergoing extracorporeal shock wave lithotripsy (ESWL) are anesthetized and immersed in water in a semi-sitting position, while high energy shock waves are traveling through their bodies. The effect of ESWL on the hemodynamics and circulating hormones are both of clinical and physiologic interest. This study delineated the effect of ESWL on cardiovascular variables and circulating epinephrine (EP) and norepinephrine (NE) levels in patients under general anesthesia.

**Methods.** Seven informed, consenting, unpremedicated, ASA PS I patients were entered in this institutionally-approved study. Their mean  $\pm$  SD age was 45 $\pm$ 14 years, weight of 85 $\pm$ 24 kg, and height of 169 $\pm$ 8 cm. A peripheral vein was cannulated and 5% dextrose in lactated Ringer's solution was given at a rate of 6-8 ml/kg/hr to increase urine output to wash out pulverized stone from the urinary tract. Blood samples were obtained from a radial arterial line; these were centrifuged and stored at -80°C for later measurement of EP and NE by radioenzymatic assay. Anesthesia was induced with thiopental, 4-6 mg/kg. Vecuronium, 0.08 mg/kg was given intravenously. The trachea was intubated and ventilation was controlled to maintain an end-tidal CO<sub>2</sub> of 34 $\pm$ 2 mm Hg. Anesthesia was maintained with isoflurane 1.1 $\pm$ 0.20% in 50% nitrous oxide and oxygen. Systemic arterial pressure was measured via an arterial line with the pressure transducer at the level of left ventricle. Body temperature was monitored by an esophageal temperature probe, and end-tidal concentrations of CO<sub>2</sub>, O<sub>2</sub>, isoflurane, and nitrous oxide were measured via a mass spectrometer (Perkin-Elmer, Pompano, CA). Cardiac output (CO) was measured continuously via a transesophageal ultrasonic Doppler probe (Accucom, Datascope Corp., Paramus, NJ). Although CO was measured continuously to enable comparison between subjects, the reported mean  $\pm$  SD values are those obtained over 3 minutes during each period (Table 1). EP and NE levels were determined during each of the following periods: 1) before induction of anesthesia; 2) after induction of anesthesia; 3) after immersion in the ESWL water bath; 4) after 300 shocks; 5) after 800 shocks; and 6) five and 10 minutes after completion of ESWL treatment with the patient in the same position and still immersed in water. Total peripheral vascular resistance (TPR) was calculated from mean arterial pressure (MAP) and CO.

Following analysis of variance for repeat measurements, a post hoc Scheffé test was used to make comparisons between group means. Statistically significant differences were considered when  $P < 0.05$ .

**Results.** There was a statistically significant decrease in CO and an increase in MAP and TPR (Table 1) with ESWL treatment. These values returned to baseline levels when treatment was stopped. Blood EP and NE levels did not change significantly in any of the sampling intervals (Table 2).

**Discussion.** Cardiovascular complications such as cardiac dysrhythmias, myocardial ischemia and infarction and cerebrovascular accidents have been reported after ESWL (1). Since we did not find a significant increase in blood EP and NE levels, we conclude that the hemodynamic changes are probably not mediated via these hormones. It has been found that large changes in catecholamine levels are required to affect hemodynamic variables (2).

#### References

- Behnia R, Shanks CA, Ovassapian A, Wilson LA: Hemodynamic responses associated with lithotripsy. *Anesth Analg* 66:354-356, 1987.
- Kopin IJ, Lake RC, Ziegler M: Plasma levels of norepinephrine. *Ann Intern Med* 88:671-680, 1978.

Table 1: HEMODYNAMIC CHANGES ASSOCIATED WITH ESWL (Mean  $\pm$  SD)

Period	HR	MAP	CO	TPR
Control	85 $\pm$ 11	73 $\pm$ 10	4.6 $\pm$ 0.7	1267 $\pm$ 242
300 shocks	84 $\pm$ 10	88 $\pm$ 13*	3.8 $\pm$ 0.7*	1895 $\pm$ 502*
800 shocks	86 $\pm$ 8	94 $\pm$ 16*	3.8 $\pm$ 0.5*	2066 $\pm$ 495*
Post-treatment	81 $\pm$ 9	82 $\pm$ 9	4.6 $\pm$ 0.5	1362 $\pm$ 259

\*Significant ( $P < 0.05$ ) change from control.

Table 2: PLASMA EPINEPHRINE AND NOREPINEPHRINE LEVELS ASSOCIATED WITH ESWL (Mean  $\pm$  SD)

Periods	EP (pg/ml)	NE (pg/ml)
Awake	164 $\pm$ 75	335 $\pm$ 224
After induction of anesthesia	102 $\pm$ 70	437 $\pm$ 133
Anesthesia and immersion in water	72 $\pm$ 58	329 $\pm$ 195
300 shocks	87 $\pm$ 62	407 $\pm$ 228
800 shocks	95 $\pm$ 58	411 $\pm$ 162
Post-treatment (5 minutes)	104 $\pm$ 68	425 $\pm$ 196
Post-treatment (10 minutes)	78 $\pm$ 43	455 $\pm$ 235