

Figure 1 based upon our experiments with dogs, shows that there is no correlation between RPP and the appearance of electrocardiographic evidence of myocardial ischemic injury. In our opinion the RPP may be used in many conditions as a simple index of total mV_{O_2} , but at the same time, this index may be a misleading predictor of intraoperative myocardial ischemic injury.

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Hyperlactatemia during Transurethral Resection of the Prostate Using Sorbitol Solution as the Urologic Irrigant

To the Editor:—Intravascular absorption of the urologic irrigant during transurethral resections of the prostate gland (TURP) is a well-documented occurrence.¹ Sorbitol, one of the nonhemolytic irrigating solutes, has enjoyed a unique popularity with urologists because it is believed to be rapidly and nontoxically metabolized in the liver.² However, intravenously administered sorbitol has been shown to produce a hyperlactatemia in healthy volunteers³ and in children during sorbitol hyperalimentation.⁴ This demonstrates sorbitol's preferential metabolic pathway to lactic acid. Therefore, a study was designed to determine whether a similar hyperlactatemia would result from the absorption of the sorbitol irrigant during TURP.

Venous serum lactate levels were measured in 18 patients during elective TURP, with anesthesia provided by spinal anesthesia (table 1). Thirteen of the patients received 3 per cent sorbitol solution (Travenol Laboratories, Deerfield, Illinois) as the urologic irrigant, while five control patients received 1.5 per cent glycine solution (McGaw Laboratories, Irvine, California). The patient populations were comparable with respect to age, perfusion height of irrigation fluid, volume of irrigation fluid used, and blood loss intraoperatively. Venous serum samples for lactate determination and arterial samples for blood-gas analysis were drawn preoperatively and 30 and 60 min after resection of the gland had begun.

In all patients receiving the sorbitol irrigant, venous

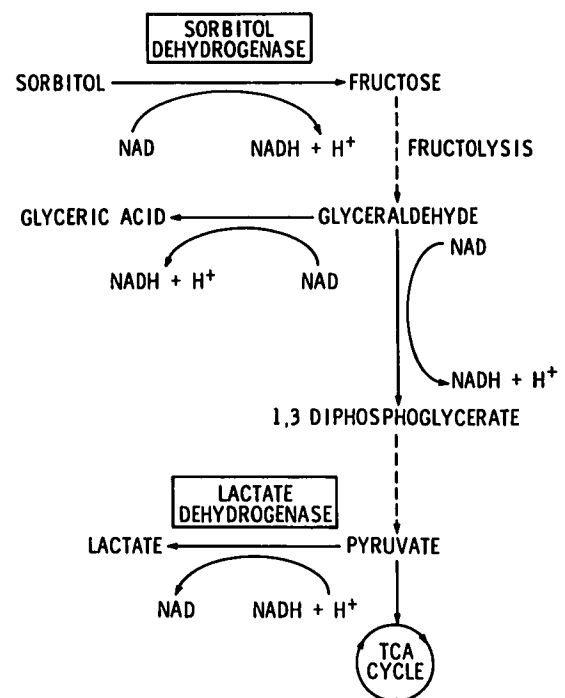


FIG. 1. Metabolic pathway of sorbitol illustrating the preferred route to lactate.

serum lactate increased significantly ($P < 0.005$), to a mean of 7.5 mg/dl (0.82 mmol/l) above preoperative values within the initial 30 min of resection. For those resections lasting longer than 30 min, venous serum

lactate increased to 13.0 mg/dl (1.44 mmol/l) above preoperative values. This resulted in an additional mean increase of 5.6 mg/dl (0.62 mmol/l) of venous serum lactate above that in the first 30-min resection period ($P < 0.005$.)

The control group receiving the glycine irrigant showed no significant elevation of venous serum lactate during either the first 30-min ($P = 0.8$) or the subsequent 30-min period ($P = 0.9$) of resection. Compared with the glycine-treated control group, the venous serum lactate concentrations of the sorbitol-treated group were significantly elevated throughout both 30-min resection periods ($P < 0.025$ and $P < 0.001$, respectively). There was no significant change in arterial blood gases throughout the resection.

Sorbitol-induced hyperlactatemia is best explained by sorbitol's favored metabolism to lactate from pyruvate (fig. 1).³ Sorbitol, in its conversion to fructose, increases the proportion of reduced to oxidized pyridine nucleotide concentration (NADH₂/NAD.) During fructolysis, additional NADH₂ is created through the conversion of glyceraldehyde to glyceric acid and from glyceraldehyde-3-phosphate to 1,3-diphosphoglycerate. Since the formation of lactate from pyruvate (pyruvate + NADH₂ \rightleftharpoons lactate + NAD) is contingent on the NADH₂/NAD ratio, this increase in NADH₂ will favor lactate production.

None of the patients in this study achieved a serum lactate level high enough to produce clinical or laboratory evidence of metabolic acidosis. Thus, although a sorbitol-induced hyperlactatemia was found during TURP, the clinical importance of the lactate levels achieved is unclear. It should be pointed out, however, that in patients having TURP procedures with metabolic compromise, this sorbitol-induced hyperlactatemia could potentially produce a significant lactic acidemia. This possibility has been alluded to in other reports.⁴⁻⁵

This benign hyperlactatemia may be falsely attributed by the unsuspecting clinician to other serious conditions such as bacteremia, hemorrhage and the TUR reaction. Therefore, this heretofore unreported finding may play an important role in the care of postoperative TURP patients.

Two- vs. Three-compartment Model for Analysis of *d*-Tubocurarine Pharmacokinetics

To the Editor:—Dr. Ham and his colleagues are to be congratulated on their studies of the pharmacokinetics and pharmacodynamics of *d*-tubocurarine (*d*Tc).¹ They demonstrated a relationship between serum *d*Tc concentration and neuromuscular block-

TABLE 1. Venous Serum Lactate Values during Transurethral Resection of Prostate Gland (TURP) with Sorbitol Irrigant or with Glycine Irrigant

Irrigants	Mean Venous Serum Lactate (mg/dl)		
	Preoperative	Time after Resection Began	
		30 Min	60 Min
Sorbitol (n = 13)	9.8	17.2*	22.8*
Glycine (n = 5)	10.4	13.0	12.3

* Significant increase over preoperative levels ($P < 0.005$).

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ade using logit transformation. We reported² a similar relationship using the sigmoid curve equation:

$$\text{Per cent paralysis} = \frac{100 \text{ per cent} \cdot C_p^s}{K^s + C_p^s} \quad (1)$$