

TITLE: LACK OF AVAILABILITY OF DANTROLENE IN AMERICAN SURGICAL FACILITIES
AN ESTIMATE OF ASSOCIATED MORTALITY

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INTRODUCTION:

There is reason to speculate that immediate, appropriately dosed dantrolene (D) therapy may reduce mortality from malignant hyperthermia (MH) to zero.^{1,2} In 1986, in Dallas, TX, 4 of 23 facilities did not have D available.³ The purpose of the present study was to examine, with a nationwide survey, the extent to which American surgical facilities are equipped to handle an acute fulminant MH reaction. The study also aimed to obtain an estimate of the mortality associated with inadequate preparedness.

METHODS AND MATERIALS:

For a mail survey 208 hospitals, and for a telephone survey 73 freestanding ambulatory surgery centers (ASC) were randomly selected. The number of facilities stocking no, fewer than 12, and fewer than 36 vials of D was determined. Facilities declaring they could obtain the drug within 5 minutes were considered as stocking D. An estimate of the number of fatalities associated with the failure to provide immediate and sufficient D therapy was obtained by multiplying the number of surgical operations in each category of all U.S. surgical facilities^{4,5} by the fraction of institutions stocking fewer than 12 vials, by the incidence rates for MH,⁶ and by the "preventable mortality" rate for MH of 28%.¹ The age distribution of MH victims⁶ was used to calculate the years of potential life before age 65 lost (YPLL) to MH according to the method of the Centers for Disease Control.⁷

RESULTS:

Of the 208 questionnaires mailed to hospital pharmacists 184 were returned, 183 were used for this analysis, as in one hospital, surgery was no longer conducted. The telephone survey was completed by 50 of the 73 ASCs. Ninety percent of the ASCs and 44% of the hospitals had a written protocol to manage malignant hyperthermia. Twenty eight percent of the hospital pharmacists reported they maintain a stock of D for another nearby hospital. Seven hospitals (4%) and 11 ASCs (22%) did not stock any D. While all of the non-stocking hospitals relied on another hospital for their D supply, only half of the non-stocking ASCs shared D stocking with a hospital, the other half had uncertain or unknown supply sources. There were three ASCs which claimed ability to procure D within five minutes. Thus, eight ASCs had no immediate access to D. None of the non-stocking hospitals was able to procure the drug within five minutes. Ten hospitals and 16 ASCs had fewer than 12 vials on the premises, they were considered as being inadequately prepared and added to those not stocking the drug. Therefore 17 hospitals (9.3%) and 24 ASCs (48%) were judged as incapable of handling the initial MH treatment. Fifty three percent of the hospitals and 20% of the ASCs had at least 36 vials available. In eight hospitals the only D supply was kept in the pharmacy. There were two ASCs which kept their D in either the pharmacy or the supervisor's office. Assuming an MH crisis incidence of 1:15,000 to 1:100,000 general anesthetics, an estimated 8 to 48 fatalities from MH are likely to occur annually in the U.S. because of failure to provide immediate D therapy, leading to a loss of 324 - 2160 years of potential life before age 65.

DISCUSSION:

This study concludes that a sizable number of surgical facilities in the United States lack a D supply and/or written protocols to adequately treat MH. We speculate that the mortality associated with this is most likely underestimated. The present survey likely oversampled those hospitals and ASCs with higher surgical volumes. Facilities with lower surgical loads stored less or no D. We conclude that the stocking of D is even less than estimated in this study. For the purpose of this study only facilities stocking fewer than 12 vials of D were considered as unprepared to treat a MH crisis initially, but more, namely 45% of the hospitals and 72% of the ASCs were not equipped to fully treat a MH episode. The

responsible individuals in these institutions must speculate on speedy delivery from some supply source for their drug needs beyond the first 5 - 10 minutes. There is evidence that this cannot be guaranteed. Additional victims may die because of stocking fewer than 36 vials. Mortality may also be associated with the practice of storing D outside of the operating room. For the purpose of this study a "preventable" mortality of MH of 28% was assumed, based on reports about deaths despite D therapy. Recently, close scrutiny of cases in which D reportedly had failed to save the life of MH victims revealed that death only occurred in those cases where the application of D had been delayed.⁸ Thus our estimates of preventable mortality are conservative, and we suspect that all mortality (39%) from MH is preventable. Assuming that failure to stock fewer than 36 vials of D might lead to loss of a MH victim's life, 72% of ASCs and 45% of hospitals in the U.S. place an MH victim at risk. Thus an estimated 41-274 fatalities may occur annually in the U.S. from MH with 1,849-12,324 YPLL. To put this into perspective: in 1984 the loss to chronic obstructive pulmonary diseases was 123,000 YPLL, and the loss to diabetes mellitus was 119,000 YPLL.⁷ Thus, because of the young age of MH victims, the YPLL better than the mortality reflects the public health importance.

The cost of D acquisition to the presently understocked facilities is very low. A supply of 36 vials of Dantrium® (D) costs \$1105.20 (cost to our hospital, 1987). The shelf life of the drug is three years. In the event that no use is made, the stocking costs \$368.40 per year. If the 360 understocked hospitals in the U.S. would increase their stock to 36 vials, they would collectively have an annual expense of \$ 122,086, or \$339.13 each. Equipping the yet understocked ASCs with an adequate supply would cost \$ 107,002 annually, or \$355.68 each. Thus a total of \$229,088 additional purchase of D would be required to adequately stock all surgical facilities in the United States. A single award in a malpractice suit may exceed that amount. Furthermore as seen above, the effect in terms of YPLL could possibly equal a reduction of 10% in the mortality from COPD or diabetes mellitus. In conclusion: 45% of the hospitals and 72% of the ASCs in the United States are not fully prepared to treat malignant hyperthermia. At a relatively low cost these facilities could be enabled to prevent fatalities. Stocking of D in all American surgical facilities would likely save 8 to 48 lives each year. Increased efforts should be undertaken to provide written protocols for the treatment of MH in all surgical facilities.

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