ORIGINAL RESEARCH

Thiopental vs. Etomidate for Rapid Sequence Intubation in Aeromedicine

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Abbreviations:
ETOM = etomidate
RSI = rapid sequence intubation
SCh = succinylcholine
THIO = thiopental

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Abstract

Introduction: Although there is a general agreement that rapid sequence intubation (RSI) is the preferred technique for intubation in aeromedical care, several pharamacological regimens have been employed without clear evidence of which is superior.

Hypothesis: This study was designed to compare the use of etomidate (ETOM) with that of thiopental (THIO) as an adjunctive agent used with succinylcholine (SCh) for RSI in an urban, aeromedical system.

Methods: This was a retrospective, before-and-after study utilizing computer-assisted chart review. Adult patients who received THIO for RSI over a two-year period were compared to adult patients who received ETOM for RSI over a similar period, after a change in protocol, which mandated ETOM rather than THIO for all intubations.

Results: No difference was found in any of the primary endpoints. Stabilization time (13.1 vs. 12.9 minutes), number of intubation attempts (1.1 vs. 1.2), successful first intubation attempts (90% vs. 82%), overall successful intubations (100% vs. 96%), and intubation time (18.4 vs. 21.7 seconds) were similar for all comparisons of THIO vs. ETOM (all $p > 0.05$).

Conclusion: This study found no clinically relevant differences between the use of ETOM or THIO as adjuncts with SCh for RSI in the aeromedical setting.

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Introduction

Although rapid sequence intubation (RSI) is utilized widely in aeromedical care, there is no consensus as to the optimal pharmacological regimen. Succinylcholine (SCh) is preferred almost universally as the paralytic component, but there are several sedative agents that reasonably could be utilized. Midazolam, thiopental (THIO), etomidate (ETOM), and others, each with their own advantages and disadvantages, each have been advocated. However, there are few data comparing these agents. The purpose of this before-and-after study was to compare the use of THIO with that of ETOM as the sedative agent used in conjunction with SCh for RSI in an aeromedical environment.

On 01 January 2000, the University of Pennsylvania/PennSTAR flight program changed their well-established RSI protocol (which previously had utilized THIO) to one that used ETOM as the sedative adjunct. Since ETOM, unlike THIO, is available in a pre-filled syringe that does not require reconstitution, the program believed that ETOM would be easier to administer in the field. The original protocol called for administration of sodium thiopental 1–3 mg/kg intravenously at the discretion of the flight crew. The ETOM-RSI protocol specified that the dose of ETOM vary with systolic blood pressure: <90 mmHg = 0.3 mg/kg and >90 mmHg = 0.6 mg/kg. All RSIs, in both the ETOM and the THIO group, utilized SCh exclusively at a dose that was limited by the protocol to 1–2 mg/kg intravenously.

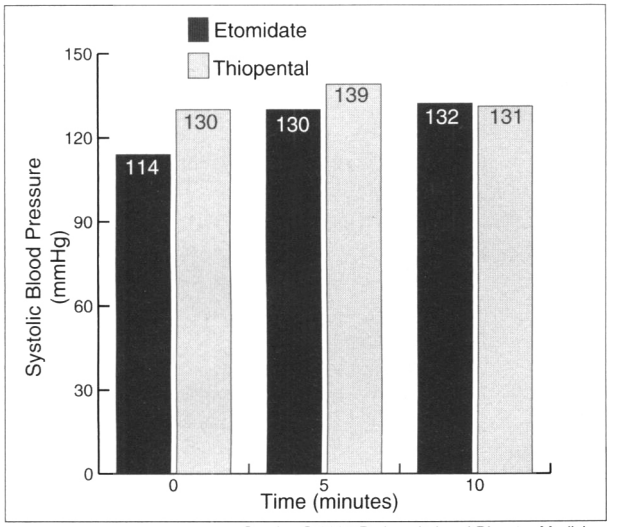

Figure 1—Mean systolic blood pressure for etomidate vs. thiopental

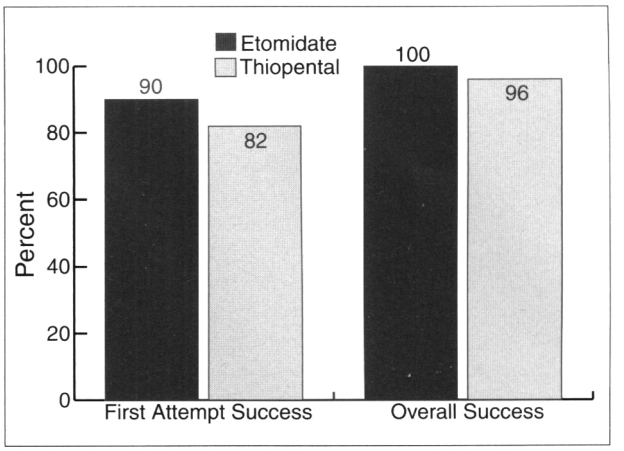

Figure 2—Percent of successful intubations

The specific endpoint of this study was to determine whether the change from THIO to ETOM for RSI had any effect on stabilization time, intubation time, post-intubation blood pressure, or the number of intubation attempts and success rates.

Methods

This retrospective, chart review compared 49 randomly selected adult patients receiving THIO for RSI from 1998–2000 to 49 adult patients receiving ETOM for RSI during the years 2000–2002. All records reviewed were from a Level-I Trauma Center-based, air-medical transport system. The control group was selected by a computer-assisted search using only the inclusion criteria (adult, trauma, 18–65 years of age, who received RSI, and had complete data charted for the parameters under investigation). The first 49 charts meeting these criteria were utilized as the control group without any attempt to match the ETOM group for demographic or clinical characteristics. Four data points were measured: (1) stabilization time; (2) time taken to intubate; (3) number of intubation attempts; and (4) intubation success rates. These times were extracted from computer-recorded time intervals documented from the original flight chart. Stabilization time was defined as the time at which the patient care was administered to the time when the patient was transported to the aircraft. Intubation time was defined as the time from THIO or ETOM administration to successful intubation. Success of intubation was defined as passage of the endotracheal tube through the vocal cords and into the trachea with confirmation of placement via auscultation of lung sounds and end tidal CO_2 measurement. Additional data collected included pre-intubation, five and ten minutes post-intubation blood pressures, and patient age.

Inclusion criteria consisted of adult patients between 18–65 years of age, who were transported by the aeromedical program for a trauma-related event that required RSI during the four-year period from 01 January 1998–01 January 2002. Records were excluded for patients <18 or >65 years old, patients not undergoing RSI, and patients with incomplete chart data.

Statistical analysis was by Pearson Chi-square and Student's *t*-test with alpha set at 0.05. This study was reviewed and designated as an exempt study by the Institutional Review Board of the University of Pennsylvania. All Health Insurance Portability and Accountability Act of 1996 (HIPPA) requirements were maintained during the course of this study.

Results

The demographic characteristics of the two groups were similar; the mean value for the ages of the ETOM population was slightly younger (29 years), compared with that of the THIO group (36 years) (p <0.01). There were 20 patients at the youngest inclusion point of 18 years old, 11 in the ETOM group, and nine in the THIO group. The oldest patients were 65 years old, one in each group. The ETOM group consisted of 37 males and 12 females; the THIO group included 31 males and 18 females (p >0.1). All RSIs for both groups occurred at trauma scenes in the prehospital environment. Flight paramedics performed 79 of the total intubations and flight nurses performed 19.

Both the ETOM and the THIO groups were given SCh for neuromuscular blockade 100% of the time. Forty-six patients in the ETOM group received one dose, and three patients received two doses of ETOM. By contrast, 21 patients in the THIO group received one dose, and 28 patients received two doses of THIO (p <0.001). All patients actually received the doses prescribed by protocol (according to estimated weight in the field), including those receiving repeat doses. Actual weights of the patients could not be verified.

Stabilization time was 13.1 minutes in the THIO group verses 12.9 minutes for the ETOM group (p = 0.91). Initial mean value for systolic blood pressure did not differ significantly between the ETOM and THIO (114.9 vs. 129.9, respectively, p >0.20). There also were no differences at five

and ten minutes post-intubation (Figure 1). There was no significant difference in the mean values for the number of intubation attempts (1.1 vs. 1.2, $p > 0.10$), success of intubation on first attempt (90% vs. 82%, $p > 0.20$) (Figure 2), overall successful intubations (49 vs. 48, 100% vs. 96%, $p > 0.30$) or intubation time (18.4 vs. 21.7 seconds, $p > 0.05$) between the ETOM and THIO groups, respectively.

Discussion

The issue of RSI in prehospital care continues to be a topic of serious debate. Still unresolved is the question of which sedative agent (if any) is the most effective and safest. Four recent case series utilizing ETOM indicated that this agent was useful and generally a safe adjunct during RSI, and one of these reports indicated that ETOM alone often was effective (89%) without the use of a paralytic agent.[1–4] A single, recent, prehospital series suggested that RSI (with SCh) with ETOM, ketamine, or a benzodiazepine was associated with a lower likelihood of successful intubation on the first attempt as compared with short-acting barbiturates or propofol, but no conclusion could be drawn as to which agent(s), if any, were superior overall.[5]

The current study compared THIO to ETOM, and also identified no difference in any of the relevant endpoints. Specifically, there were no significant differences in the number of intubation attempts, intubation times, or overall success rates, nor was there any significant change in blood pressure post-intubation. The only statistically significant differences between the two medications noted was in the requirement of an additional dose of sedative in almost half of those undergoing RSI with THIO. Although ETOM would appear to be a superior agent for RSI when considering only the need for subsequent doses of THIO, the differences in dosing administration of THIO (1–3 mg/kg IV push at the discretion of the flight crew) vs. the more strictly defined dosing of ETOM (0.3 mg/kg for systolic blood pressure <90 mmHg and 0.6 mg/kg for >90 mmHg) is notable. Although the doses of both agents are consistent with those commonly recommended for intubation, it is possible that with a different and more rigid THIO dosing schedule, no differences in need for repeat dosing would be evident. The concern regarding ETOM's effect on the neurohumoral axis, particularly reports of adrenal suppression, has limited the use of this agent in some critical care settings. Over the brief time points considered in this study, there was no evidence of such an effect based on pulse rates and blood pressures.

This study has several limitations. The primary limitation is the before-and-after methodology. The study does not compare concurrently the two agents in a prospective, randomized, controlled fashion. Clearly, the data collection was dependent upon the accuracy of the flight chart documentation. Another limitation is that, although all patients intubated with ETOM after the protocol change were included, these subjects were not matched (for example, by demographics, injury severity, or identity of the intubator) with those intubated with THIO in the prior two-year period. It is believed that this limitation in study design is mitigated by the fact that personnel and protocols essentially were unchanged during the period of study as were the types and severity of patients transported. Finally, this was a prehospital study; patients were not followed after hospital arrival to identify differences in eventual patient outcomes.

Conclusion

Thiopental and etomidate have similar efficacy and safety when used as sedative adjuncts for rapid sequence intubation in aeromedical care.

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