Retrospective evaluation of the simplified Therapeutic Intervention Scoring System (TISS-28) in a surgical intensive care unit

Abstract  Objective: To compare the simplified Therapeutic Intervention Scoring System (TISS-28) with its original version, to provide reference values of daily TISS-28 assessment and to describe its association with severity of illness in surgical patients.

Design: Retrospective evaluation of prospectively collected audit data; four documentation periods.

Setting: Ten-bed intensive care unit (ICU) in a surgical university hospital.

Patients: One thousand nine hundred eighty-six consecutive admissions (1,808 patients; 10,448 observation days) who stayed on ICU for at least 6 h. Patients were in hospital for abdominal, vascular or trauma surgery. The average age was 61.5 years, the mean APACHE II score on admission 10.3 points.

Interventions: None.

Measurements: Raw data for APACHE II score and TISS were recorded daily. TISS-28 was calculated retrospectively from the original TISS data.

Results: Average TISS-28 values (28.7 points; SD = 9.7) do not differ substantially from the original TISS values (28.2 points, SD = 10.9) and overall correlation is high ($r = 0.935$). Of the patients, 57.3% left the ICU after 1–2 days as survivors with a mean daily TISS-28 of 20.0 points. Variability between documentation periods was higher with the original TISS. On average, patients with increasing severity of disease require an increasing amount of care. Survivors have lower TISS-28 values than non-survivors (27.6 vs 34.9).

Conclusions: In a surgical ICU the simplified version of TISS with 28 items (TISS-28) sufficiently reflects the amount of intensive care provided and may provide useful additional information on severity of disease and prognosis. It should replace the original index, at least in these cases.

Key words  Intensive care unit · Score systems · Therapeutic Intervention Scoring System · Severity of illness index

Introduction

Since its introduction in 1974 the Therapeutic Intervention Scoring System (TISS) [1, 2] has been widely used and accepted as an instrument to measure therapeutic, diagnostic and nursing activities in intensive care. Although initially designed to measure severity of illness as well, it has been used almost exclusively for quantification of resource utilization and nursing workload. But the TISS was often criticized for being time-consuming, poorly defined, incomplete and outdated by medical technology. Many modifications of TISS are used to meet the local requirements of intensive care. This has led to a limited comparability between separate institutions.

In 1996, a simplified version of TISS with only 28 items (TISS-28) was published by Reis Miranda et al. [3] based on a detailed analysis of 10,000 records from
the database of the Federation for Research on Intensive Care in Europe. This new TISS-28 score is already widely used, although systematic evaluations in large groups of patients are still missing. Until now there have only been two multicenter studies, from Portugal [4] and Spain [5], but these investigations only consider data from the 1st day of ICU stay in mostly medical cases.

The present study evaluates both versions of TISS and gives detailed results from daily assessment based on a prospective database of adult surgical intensive care patients.

Materials and methods

Patients and setting

The surgical intensive care unit (ICU) at the 2nd Department of Surgery of the University of Cologne has ten beds and is directed in cooperation with the Department of Anesthesiology. Four out of five patients admitted to the ICU are postoperative cases. Patients treated in the ICU are admitted to the hospital for abdominal or vascular surgery, or after multiple injury. About half of the patients are admitted for postoperative surveillance and leave the ICU within 24 h after admission.

Data collection

In 1993 a quality control program was initiated with daily assessment of all patients who stayed on the ICU for at least 6 h. Documentation consisted of an initial assessment (age, sex, diagnostic category, chronic health, indication for admission) and subsequent daily assessment of the patients’ physiology (e.g., temperature, blood pressure, heart rate) necessary for calculating the Acute Physiology and Chronic Health Evaluation (APACHE) II score [6]. The Glasgow Coma Scale was assessed only if the patient was not intubated or sedated, otherwise it was considered normal (15 points, i.e., no points in the APACHE II score). All interventions necessary for daily assessment of TISS were documented as well. The daily documentation period (usually 24 h) started at 6 a.m. with the morning shift. Periods of less than 6 h at the beginning or at the end of ICU stay were merged with the following or previous day, respectively. Raw data were collected from the patients’ records and coded on a documentation sheet. On the same day, data were put into a computer database (RIYADH Intensive Care Programme, Medical Associated Software House, London, UK). Hospital outcome was retrospectively added to the database when the patient died or left the clinic. Data collection was carried out independently of the ICU staff by medical students (two per documentation period) who were initially trained and supplied with a manual for data management.

The quality control program was structured in four documentation periods each with a duration of 9–12 months. After each period an analysis was performed and the results were discussed internally. As soon as inconsistencies of documentation were observed, the existing manual for data collection was updated in order to clarify definitions and to improve the identification of the sources of data in the patients’ records.

Scores

APACHE II and TISS score points were calculated by the documentation software. TISS-28 scores were composed retrospectively from the documented original TISS items according to the description given by Reis Miranda [3]. The number of therapeutic and nursing activities documented (n = 104) exceeded the number of the original TISS items (n = 76). Where applicable, non-TISS items were used to modify the calculated TISS-28 values (e.g., CT scan as a specific intervention outside the ICU, or renal dose of dopamine as medication). The Nine Equivalents of Nursing Manpower Use Score (NEMS) was calculated from a subset of TISS-28 items with appropriately modified weights [7].

Statistics

Data are presented as means and standard deviation (SD) where appropriate. Statistical tests were not applied in order to avoid arbitrary significant results based on the large number of cases rather than on clinically relevant differences. Association between TISS-76 and TISS-28 was assessed using Pearson’s correlation coefficient, a linear regression analysis and a deviation plot according to Bland and Altman [8]. In this plot the difference between the two measurements (TISS-28 minus TISS-76) is plotted against its average magnitude [(TISS-28 + TISS-76)/2] for each patient. Stepwise logistic regression analysis was applied to evaluate APACHE II and TISS-28 on the day of admission for prediction of hospital mortality in primary admitted patients. Data analysis was performed with the statistical software package SPSS 9.0 (SPCC, Chicago Ill, 1997).

Results

During the total period of 40 months, 1,986 admissions were documented. Patients readmitted to the ICU during hospital stay (n = 178; 9.0%) were included in the analysis. One hundred fifty-eight patients died in the ICU (8.0% of all admissions). Total hospital mortality was 14.9% (based on 1,808 individual patients). The basic characteristics of the admitted patients are given in Table 1. Of the patients, 79% have had surgery prior to ICU admission (elective cases: 48%; emergencies: 31%). Most patients (58.9%; 1107 survivors; 30 non-survivors) left ICU within the first 2 days after admission. The mean ICU stay was 5.3 days (median: 1 day).

Among the 10,534 patient days documented, 10,448 days (99.2%; 1,953 admissions) had a valid TISS assessment. A total of 294,699 TISS-76 points were documented during the whole period. Mean daily TISS values were 28.2 (SD 10.9; range: 2–73) and 28.7 (SD 9.7; range: 4–61) for the versions with 76 and 28 items, respectively. Average daily TISS-28 values for diagnostic subgroups varied between 25.2 and 29.4. Highest values were observed in the group of trauma patients with the TISS-28 (1st day: 30.4; SD 10.6; n = 244 admissions/total: 29.4; SD 9.7; n = 3,111 days) as well as with the TISS-76 (31.2; SD 13.2 and 29.4; SD 11.2, respectively).