HOW THE SAS SYSTEM IS USED BY DIVISION OF CARDIOVASCULAR SURGERY AT TORONTO GENERAL HOSPITAL

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Abstract

SAS system was chosen as the software package for implementing data bases at the Division of Cardiovascular Surgery at Toronto General Hospital. Among the many retrospective and prospective studies done by the Division, four ongoing data bases were established between the period of 1980 to 1983:

- **Metro Toronto Open Heart Data Base**
  - To collect clinical, operative and post-operative data on each patient in order to document indications and results in the city-wide practice of Cardiovascular surgery.

- **Physiological Data Base**
  - To examine myocardial performance as a result of various techniques used on patients during cardiopulmonary bypass.

- **Intra-Aortic Balloon Pump Data Base**
  - To document each patient that requires balloon counterpulsation, providing information on patient survival and complications.

- **Dual Chamber Pacemaker Data Base**
  - To monitor the on-going follow-up and clinical importance of the new technique of dual chamber pacing.

Standard frequency analyses, means and standard deviations are done within the data base. The authors found it easy to select and analyse various subgroups of the data. Complex regression and analyses of variance, including multiple comparison of means, are done on a routine basis on the Physiological study to compare myocardial function for different times and interventions. By using the MACRO statement we have been able to generate appropriate reports to suit different requirements of individuals with minimal programming effort.

Introduction

In 1980, the SAS system was used for Cardiovascular surgery research at Toronto General Hospital. Numerous retrospective and prospective studies were accomplished in the Division since 1980. In the period of 1980 to 1983, four ongoing data bases were established.

The system has facilitated data analyses and report generation for researchers. It was selected for:

- flexibility
- ability to handle large volumes of data
- capability to perform advanced statistical analyses
- ease of use of the package

The present implementation has proven to be very satisfactory in meeting the stringent criteria set forth in an earlier study (Tong et al, 1983). In this presentation, we shall introduce our experience with the implementation of the SAS system. Our discussion will focus in the following areas:

- brief description of each of the data bases
- file management aspects of the SAS system
- analyses of the data

Data Bases Description

**Metro Toronto Adult Open Heart Data Base**

- The city of Toronto is one of the major open heart centers in Canada. In 1981, the three hospitals that perform open heart surgery agreed to participate in the data collection project. The purpose of setting up this data base are:
  - to collect patient clinical information on a city-wide basis
  - to document indications for surgery, surgical anatomy and type of operations performed
  - to evaluate immediate post-operative morbidity and mortality

A variety of different comparisons are made for each hospital, including comparing patients with different clinical presentations; urgency; ventricular function; valve lesions and types.

**Physiological Data Base**

- An extensive and detailed documentation on each surgical patient in order to:
  - examine myocardial performance resulting from various techniques
  - measure myocardial metabolism before, during and after cardiopulmonary bypass
  - assess pre- and post-operative ventricular function

The hemodynamic data serves as a baseline for many different studies.

**Intra Aortic Balloon Pump Data Base**

- The intra aortic balloon pump is a cardiac assist device for patients that require temporary augmentation of the circulatory function. The data base is set up to:
  - document each patient that requires balloon counterpulsation
  - assess the relationship of the complication rate of the procedure
  - examine the type of balloon; the insertion technique and the clinical indication

**Dual Chamber Pacemaker Data Base**

- Toronto General Hospital runs one of the largest pacemaker clinics in North America. Dual chamber pacemakers and polyurethane leads have been implanted here since 1981. Establish-
ing the data base was mandatory due to the rapid advance in the pacing technology. The data base enables physicians and researchers to:

- evaluate various type of dual chamber pacemakers used, i.e. the performance of the individual models
- measure stability and function of dual chamber pacemakers
- examine the performance of leads as indicated by complications and maintenance procedures
- monitor the on-going patient follow-up

File Management

- SAS system has made updating easy. Our data bases are changing constantly as new tests are added and new variables derived
- Using arrays, new linear combinations are calculated for each variable in the data base. As the data base expands over time, only minimal re-programming is required
- Macros were used to select strings of variables for analyses, avoiding time-consuming typing

Analyses

- Basic descriptive statistics such as means, standard error, standard deviation and frequency distribution were easily obtained
- Simple comparisons of discrete data by chi-square and continuous data by t-tests are done routinely. The use of plotting and regression procedures enable us to see our data trends, spot outliers and do projections
- Complex regression and analyses of variance, including multiple comparisons of means, are handled easily by GLM, even though our data are frequently unbalanced

Conclusion

The meaning of "data analyses" is different for each of the data bases. Methods used in data analyses vary from the simplest display of data in a plot and calculations of statistics, such as the mean and standard deviation, to sophisticated methods of analysis of variance. A set of data is usually analysed many times by the SAS system. For example, outliers are spotted first, then necessary transformations and/or subgrouping can be performed, meaningful hypotheses tested, or relationship between the variables examined. The results of an analysis usually suggest that further analyses are needed.

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