THE ILLINOIS E-Z SORT
ANESTHESIA RECORD CARD

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The search for an efficient, flexible system of maintaining anesthesia records has gone on for at least two decades (1–5). Each new system has been an improvement over the previous ones, only to become obsolete with the development of new agents and techniques. In devising a new system, basic requirements of the Joint Committee on Accreditation of Hospitals and other official bodies must be met; that is, a complete anesthesia record must be filed in the patient’s clinical chart. In addition, the clinical record should be a modality of teaching and learning as well as a medicolegal document. Each record must be specific for the job it performs and also permit expansion.

Since record keeping is not an end in itself, but a means toward the end of obtaining information, the ease with which this information may be extracted is an index of the efficiency of the system. The need for special equipment to maintain records or extract information should be minimal. The simpler a record system is to maintain, the less likely it is to require the assistance of skilled individuals to use it and the more valuable it becomes to the average user. In the case of anesthesia records, they should be so simple that a competent secretary or a medical student can complete and understand them. This is especially true in that even the trained anesthesiologist cannot give his fullest attention to his patient while completing a complicated record.

Flexibility is also an important feature. Values change and the things that are important today may be much less so tomorrow. Statistics are only as valuable as the data they are compiled from are accurate, truthful, and complete. Thus the initial record keeping becomes the most important part of any statistical study.

Finally, in a given system of anesthesia records it is important that space be available for all current techniques, agents, methods and all data about the patient, such as, physical condition, preoperative or postoperative complicating factors, or cause of death. It is important that everything be included in the chart which may possibly occur during the conduct of a case, since the majority of deficiencies in records are those of omission of pertinent information. In other words, what is not asked is not answered. In the previous anesthesia records the gathering of statistical data regarding preoperative and postoperative

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complications has been particularly difficult. Newly developed techniques such as the use of hypothermia, hypotension, or mechanical respiration-assisting or controlling devices cannot easily be coded on pre-existing forms, although they have come to be accepted standard anesthetic techniques.

With the above criteria in mind, a new anesthesia record form was devised, which we believe fulfills most of the requirements.

The various systems of record maintenance were studied to determine that best suited to the purposes of clinical anesthesiology. Written records of the type ordinarily kept in most hospitals are relatively low in cost, leave some room for expansion, potentially provide adequate information, and are relatively easy to prepare, but they lack the first essential of ease in extracting the information from the record. Records such as the IBM card, and others, allow for ease of extraction, some flexibility, and completeness of data; but they have the serious disadvantage of requiring coding and cannot easily be maintained by relatively unskilled workers while they are conducting other tasks, for example, clinical administration of anesthesia. This is so because the electric sorter is a mechanical computing system based on variables in given figures, and each clinical entity would of necessity require translation into a numerical code before being usable in this type of apparatus. Since the variables involved in clinical anesthesia are innumerable and since the learning of the code and marking of such cards is a rather involved technical activity, this type of record was discarded early as being impractical (6). Work sheets were filled out during clinical anesthesia and the information thereon had to be placed on the “electronic cards” in a separate procedure allowing much room for error in transcription as well as requiring the services of a clerk or other specially trained person to do the actual coding.

In spite of the disadvantages the “electronic card” is superior for certain specific uses—particularly where special studies are to be made on predetermined phases. The edge punch card, however, has the great advantage of versatility. Slightly more time is required to collect data from the edge punch card than from the electronic one. But the punch card may be studied for different phases of any problem which need not be predetermined, since practically all of the variables are recorded as they occur.

In most respects the edge punch card is the one of choice for maintenance of anesthesia records. The edge punch card has the additional advantage that it combines the data for analysis with the clinical case record. When a specific card is sorted it contains all of the original data in the clinical record.

Edge punch cards have been widely used for the past few years. One such, the Chicago Keysort card (5), was taken as a basis from which the present card was developed. The Chicago card lacks many of the important features enumerated above. It leaves little or no
room for expansion and addition of new agents, techniques or other desirable data. It makes the recording of data on the card relatively easy, but because of format it offers relatively few punches, thereby severely limiting the quantity of data which can be punched. The E-Z Sort card was chosen because it offers a much larger number of punches and thereby allows the collection of much more data besides permitting the reservation of space for modernization and additions. At a casual glance this card appears exceedingly complicated. Yet, on closer inspection, the seeming complexity resolves into its most important advantage. This is the fact that a minimum of writing is necessary to complete the required entries. Almost every conceivable presently used technique, agent and complication is already printed on the card, requiring only a minimal amount of checking. Once the user is familiar with the card it becomes very simple to maintain it.

The specific advantages of the new card over the Keysort card are several. The face of the card (fig. 1) has been turned so that the graphic chart can extend over a longer period of time than that formerly employed (four and one-half hours if five-minute intervals are used or nine hours if ten-minute intervals are employed). This serves to conserve filing space and use of forms on long cases. Since even a ten-minute case requires a form, nothing is lost on short cases.

The upper portion of the body of the card (fig. 1) contains spaces for identification of patient, date, anesthesia number, operation proposed, and summary of positive findings. It is, we believe, better arranged and more specific than most of the older cards. This section could be rearranged with little modification to suit the purposes of institutions where some form of mechanical reproduction of patient identification data is employed.

Six blank lines are left for designation of agents. This was done to save space since all the agents could not be listed by name. It offers the additional advantage in that the primary or most important anesthetic agents can be listed first with supplemental agents on the line below or, if desired, agents may be listed as used chronologically with the first used on the top line and each succeeding one on the line below. Induction agents are frequently different from maintenance and emergence agents. It is rare that more than 4 or 5 agents would be employed in the conduct of any anesthetic, so that 6 lines leave ample room for even the most extreme cases. In addition, 2 lines are left for the notation of relaxant drugs since these are now extremely important, but should be considered to be adjuvant drugs rather than anesthetic agents per se. A box is left at the end of each line for recording the total dose of these drugs.

The space allotted to the “remarks” column is smaller than that ordinarily found in most record forms. This was made possible by the specific inclusion in the printed portions of the card of a large part of the material, for example, curare drugs, intravenous fluids, anal-
gesics, and others, which is frequently entered under "remarks." Thus the need for this particular section is diminished and it can accordingly be given less space.

It should be emphasized at this point that all the information to be punched is also contained in the central portion of the card. Thus, punching can be done at a later time than during the operative procedure if so desired, preferably by the anesthetist himself, or when required by a clerk or other person. The anesthetist should circle the appropriate portions of the card to be punched prior to, during, or at the termination of the procedure.

Some of the sections of the card will now be discussed in detail.

SPEC. INT. (fig. 1, upper left corner).—This section will be punched at the direction of the particular department head, to indicate cases of unusual interest.

It is an identifying means for quickly sorting the unusual from the more routine cases. For example, in this section cases of unusual surgical interest such as rare tumors or extraordinary surgical procedures could be punched shallow, while cases of particular anesthesia interest could be punched deep. Unusual techniques or new agents not under special study could be punched here, as could extraordinarily complicated cases or those to be made the subjects of reports.

ANESTHESIA TIME AND OPERATIVE TIME.—These sections provide somewhat more of a breakdown than some of the older records in that one-half, one, and one-half hour cases can all be shown. Cases longer than five hours in duration are relatively infrequent, and it is relatively unimportant to distinguish between a six hour and a nine hour case since both are extremely prolonged surgical procedures and since they represent less than 3% of all surgical cases.

SPECIAL STUDIES.—This section is distinguished from "Special Interest" above in that it is used for the recording of particular research studies rather than just interesting or unusual cases. Each study may be assigned a specific number which is punched as directed by the head of the department. Through the use of this section, as many as twenty different research studies can be carried on simultaneously. By means of reassignment of given numbers after a significant lapse of time the section can be used for an almost infinite period.

This section can be of as much use to the surgeon as it is to the anesthesiologist. For example, if it is desired to study all cases of cyanotic children having intrathoracic cardiac surgery with hypothermic technique it would ordinarily require sorting in four sections of the chart—age, site of operation, preoperative cardiovascular complications, and anesthetic technique—whereas if such cases were arbitrarily assigned a number in the special studies section their charts could be found in a single sort. Other examples of special studies might be "cardiac arrest" cases, reactions to local anesthesia, the "ether analgesia" technique, or hypnosis, which is again undergoing a period of increasing popularity. Each of these could be assigned a specific number in this section of the chart and the records of these cases could thus be made readily available. New agents undergoing clinical trial and new techniques of anesthesia are particularly suited to the use of this section. This differs from the "Special Interest" section in that
each study is specially identified by its own punch and much needless sorting is avoided.

PREPARATORY THERAPY.—This section is an innovation in the present card. It is used for the recording of maintenance therapy prior to anesthesia with drugs which may affect the conduct or outcome of anesthesia or surgery. This is distinguished from preanesthetic medication in that it represents maintenance therapy such as cortisone, digitalis, antihypertensive drugs, chlorpromazine, or insulin, which was being employed preoperatively.

To our knowledge this type of therapy has not previously been recorded and therefore the use of this section may require somewhat more explanation than some of the other parts of the card. We felt it necessary to include such a section since the advent of a large number of newer drugs in recent years has complicated the administration of anesthesia. Many of these drugs such as the newer hormones or tranquilizing preparations can cause serious physiologic disturbances when anesthesia is subsequently administered unless the anesthesiologist has been informed of their use and has taken proper precautions. It is not the purpose of this treatise to discuss individually the various therapeutic agents which may effect the conduct of anesthesia. This space is provided with 12 punches, only 5 of which are assigned to named drugs (fig. 1). The remaining 7 are available for additional use as desired.

AGE OF PATIENT.—This section differs only slightly, but significantly from previous cards. The ages recorded are in years. The first punch (1) covers all infants from newborn to 1 year of age. The second (5) covers all patients from 1 to 5 years. These pediatric cases have largely been neglected in previous recording by decades, but from the point of view of the anesthesiologist the young child presents very different problems than does the older child or adult. For this reason it was decided to include this group in a separate punch. From here on the age is classified by decades up to age 70. Patients over 70 years of age generally are classified as geriatric cases so that it was not considered important to break down further the age groups beyond 70.

The upper portion of the right-hand side of the card represents site of operation much in the same manner used in older cards. The sections below this refer to type of operative procedure—diagnostic, therapeutic, definitive, palliative, major or minor—conceivably a given operation might be, for example, therapeutic, definitive and major. These have all been available for indication on previous record forms but the authors feel that the arrangement has been such that they were not fully utilized. Here they are placed in a single section of the card and easily punched. The section "palliative" is a particularly important one when used in conjunction with the "death" section described below. This refers to operative procedures done for comfort of the patient, relief of pain or improvement of nursing care, where cure is not anticipated. In the event such a patient should die, the connotation of this death would be different, even should death occur in reasonable proximity to the time of surgery.

ANESTHESIA OR ANALGESIA.—This refers to the type of services rendered by the anesthesiologist. Usually it will be the former, but in such cases as burn dressings, painful examinations, or first and second stages of labor the analgesic techniques may be employed. Also in therapeutic nerve blocks for pain, analgesia may be all that is required.
DEATH.—This section classifies deaths as preventable or nonpreventable and as to whether or not anesthesia contributed. The accurate use of this section requires a full discussion of the case by all concerned prior to punching. It should not be abused by punching without mature consideration of all deaths. If autopsy has not been done the entire clinical record including the anesthesia chart should be very carefully reviewed and the department should sit in judgment as to whether each death was preventable or nonpreventable and as to whether or not anesthesia contributed. It is rare in any ordinary department that more than a few deaths would occur in a month's time. It is, therefore, logical to suggest that all deaths be discussed in a monthly departmental meeting after which this section of the cards concerned could be punched. In some areas all deaths are reviewed by a study commission which attempts after consideration of all the determinable factors to place responsibility for all postoperative or postanesthetic demises. This is done without any other goal than the improvement of medical care and prevention of needless death. This section of the card can be adapted to this use.

Sections "B" and "C" are unassigned and may be utilized in any manner desired by a specific department head. Examples of use of this section might be for recording cardiac arrest, occurrences such as neurological complications of spinal anesthesia, specific drug reactions, or any of numerous other desired data.

On the reverse side of the card (fig. 2) is concentrated the material of primary interest to one making a complete study of various phases of a given case. Whereas the face of the card furnishes the data to satisfy medicolegal requirements of anesthesia records, it is in the back of the card that the majority of the important statistical data becomes available. The reverse of the card is placed in the vertical position so that the punching is likewise on the right and left hand margins.

The section on preoperative and postoperative complications (fig. 2) in the lower left hand portion of the reverse of the card is a marked advance, we believe. It permits punching of all preanesthetic and postanesthetic complications plus recording of specific complications. An ingenious punching device permits punching of either preoperative complications, postoperative complications or both plus an additional line for deaths occurring. The first hole represents preoperative complications only. The second, postoperative only. If both preoperative and postoperative are present in the same category, the third hole is punched and if death ensues, the fourth is punched. For example: A patient with pulmonary tuberculosis, active, would have the first hole punched under "Resp. Major." If this same patient then developed atelectasis postoperatively the third hole would then be punched, whereas had the patient developed atelectasis without the pre-existing tuberculosis the second hole would be punched.

Preoperative complications under any of the systems listed may be punched at the time of the preoperative visit to the patient. Should such a patient later develop postoperative complications in the same section this could then be easily recorded by punching the third instead of the second hole. If death later ensued it could still be indicated by punching the fourth hole. The specific complications are not individually punched but the more common ones are grouped according to systems and printed on the lines opposite the system punched. For example: under the heading "NEUR DISEASES" is listed "psychosis." If a patient developed a psychotic episode postoperatively this section would be punched in the second hole and psychosis circled with a pencil with the notation "P.O."
Fig. 2. Reverse of Illinois E2 Sort record card.

In the event the patient was a known epileptic and the anesthetic resulted in no aggravation of his epilepsy, the first hole in this section would be punched and the word "SEP/SEP" circled with the notation "Fr. Op." after it.

In a similar manner each of the sections of the grouping is handled. The specific complications are circled or written in and the applicable punch is made for the group under which a specific complication is classified.
It is true that if one were searching for cases of a specific complicating disease, for example, "nephritis" it would be necessary to extract all cards for "GU diseases" and then hand sort for "nephritis." The number of cards to be thus hand sorted would not ordinarily be unwieldy and in the event that it were known in advance that a certain specific disease or condition was to be studied, the punch "B" on the face of the card could then be utilized for this purpose.

For example, in a mental hospital it is to be expected that a good proportion of all patients would have neuropsychiatric disorders. In the event it was desired to study epilepsies in such a hospital, punch "B" shallow on the face of the card (lower right corner) could be assigned to epilepsy and this would tend to simplify sorting. Punch "C" might likewise be assigned to manic depressive psychosis if desired.

The right hand border of the reverse of the card represents techniques and agents of anesthesia plus complications occurring during administration. The topmost section includes techniques of general anesthesia. The four holes at each technique represent respectively (1) induction, (2) maintenance, (3) emergence and (4) supplemental. (The latter referring to techniques used to supplement the maintenance with another agent, for example: intravenous supplementing inhalation).

The second section classifies the types of tracheal intubation.

The next two sections include techniques of spinal and regional blocks. A line is also available for hypothermia, refrigeration, etc. The inclusion of specific punches for various techniques of regional block is an advance over older records, which usually showed only a single designation of "regional block." The specific blocks are so arranged in the format that various combinations such as sciatic and femoral blocks which are frequently used together can be shown separately or combined.

Anesthetic agents are next listed. The regional agents first with suitable blank spaces for adding newer drugs. The agents for general anesthetics are again provided with classifying punches, namely: (1) primary, (2) induction, (3) supplementary, (4) emergence.

Finally a section is provided in the lower right hand corner for recording anesthetic complications and the time of their occurrence during induction, maintenance, emergence or following premedication.

These complications are those which occur during the conduct of an anesthetic. They may appear brief and unimportant when they occur but later may prove to be clues to the reason for complications. An example would be the patient undergoing transurethral prostatic resection who develops a transitory hypotensive episode lasting 8 or 10 minutes. Several days later this same patient may show signs of cerebral thrombosis. Referring to the anesthesia chart the second hole (maintenance) under the designation "CIRC" would be punched in the anesthesia complications section. Likewise, the various other lines in this section are used, "MECH" is punched when equipment fails to function properly, gas machines out of order, needles broken, etc. "RESP" would be used when such things as laryngospasm or respiratory obstruction occur. "METAB" refers to such things as thyroid or adrenal crises. "NEUR" could be used to show such things as radial nerve injury from pressure against the operating table. "G1" could show such things as emesis during spinal anesthesia. A blank line is left for other complications which might occur.
Through the use of this card we feel that much needless searching of records for statistical data can readily be avoided. It is not intended or implied that this card in its present form is suitable for all institutions without modification. It is merely presented as a prototype which shows the way to include in one form all of the many and varied phases of modern anesthesia. Modifications can and will be made from time to time. One worker, Dr. Gordon Wyant of Saskatoon, Canada, has already modified the card since his hospital uses records 8½ inches by 11 inches in size. He has maintained uniformity of records by enlarging the card and making several small alterations. The authors feel that the Illinois E-Z Sort card is of a size which will be in keeping with the large majority of hospital record forms, however, and thus we prefer this card.

**SUMMARY**

The Illinois E-Z Sort anesthesia card has been in use in its present form for a period of more than one year in several hospitals. It has been the experience of the authors that the card is easy to learn and use. It is complete as far as modern anesthesia techniques and agents are concerned and also permits room for future developments in the specialty. Its greatest value has been in the ease with which statistical data can be gathered. It has thus been a great aid in both the teaching and research programs.

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**REFERENCES**