BURNCASE 3D: A RESEARCH PRODUCT FOR EFFECTIVE AND TIME-SAVING DOCUMENTATION OF BURN INJURIES

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SUMMARY. Research, science, and costing in burns are based on accurate assessment and documentation of burn injuries. This kind of documentation is time-consuming and labour-intensive. In order to reduce the work load for documentation and coding, a research project was started between Upper Austrian Research, a research department of the federal state of Upper Austria, the University of Applied Sciences Hagenberg, and Dr Herbert Haller and Dr Christian Rodemund. The basic idea is to paint the burn injury as well as surgical procedures on a three-dimensional model. This input generates automatically clear text as well as graphic reports concerning the extent and degree of burns, together with all necessary codes such as ICD 9 or 10, OPS, MEL codes, probability of survival, ABSI and others. Input can be performed as a description of the local burn wound situation (diagnosis), operative procedure, dressing procedure, and advice for nursing. The chronological sequence of such inputs can be visualized and printed together with the corresponding codes. Additionally, photos can be stored and visualized when needed. The graphic system is linked to a database, which keeps all details necessary for documentation of burns concerning the accident, emergency aid, admission to hospital, anaesthesiological data, outcome, complication register, and so on. This database is based on ABA-WHO Standards and has to be adjusted to the needs of EBA or national multi-centre studies. This system is parameterized flexibly so that users can decide which data they want to register.

1. Introduction

The research project BurnCase is being carried out at the Upper Austrian Research Department for Medical-Informatics in Hagenberg. The project partners are the Polytechnic University of Hagenberg and the AUVA Unfallkrankenhaus Linz.

The project’s goal is the development of a software system that supports and enhances the documentation and diagnosis of human burn injuries, thus alleviating the large variations between surgeons regarding approximation of the size and depth of burn injuries. The problem is that the results of injured surface approximation vary enormously, depending on the surgeon’s experience and the subjectivity of the approximation process. The software system BurnCase 3D Core is intended to simplify and support the approximation process as well as to offer profound support for documentation and management purposes in hospitals, especially in therapy centres for burn injuries. Another problem in modern burn care is the large variety in quantity and quality of surveyed data between different burn units, as also the lack of mechanisms for exchanging documented data. To address this problem, BurnCase 3D Core offers the possibility of comprehensive documentation of a burn case.

The strength of BurnCase 3D Core is the intuitive three-dimensional graphic interface (compare Coomans1) that provides direct interaction with a virtual model of the patient’s body. Thus, representations of injured regions can be transferred onto this model by using standard input devices like the mouse and then enhanced by modern software technologies involving graphic interaction, complete database support, and analysis methods. One of the main goals is to provide a user interface which is practicable in a surgeon’s daily use.

2. Fundamentals

2.1 3D human body models

The patient’s body is visualized by a three-dimensional triangle mesh with a resolution of less than one cm², consisting of more than 90,000 triangles.

In order to achieve accuracy for the divergent body shapes of different patients, BurnCase 3D Core offers a library of standard models from which the surgeon can select the best suitable model. After this choice, the model is adapted automatically to the real patient’s physical condition (height and weight).

BurnCase 3D Core offers a library of seven different standard models representing different sex, age, and physique. It is, of course, possible to extend the standard model library by more precise and diversified body shapes (Fig. 1).
Although the different standard models provide an accurate approach to the real patient’s body shape, it is necessary to adapt the surface of these standard models to fit the patient’s height and weight. First of all, the model mesh has to be adapted in terms of body height. This is achieved by simply stretching or shrinking the mesh along the longitudinal body axis (vertical axis along the spine). This height adaptation is, however, not sufficient for realistic model adaptation. A patient of 180 cm height and 70 kg weight has a completely different body shape from that of a patient of the same height and weighing 120 kg. Thus, the body surface also has to
be adapted to the patient’s weight. The average body surface area (BSA) is therefore approximated based on several formulas which calculate BSA according to age, sex, weight, and height based on empirical statistic data. The model adaptation is done by expanding the surface along the normal vectors of the mesh polygons until the approximated destination surface area is reached. This adaptation must not change the model proportions between corpus and extremities, and it takes into account the growing behaviours of different body regions.

The following standard formulas for calculating BSA are integrated into the BurnCase 3D Core system and can be chosen by the surgeon:

1. Mosteller [Mosteller, 1987]

\[ A_{BSA} = \left( \frac{H \cdot W}{10000} \right)^{3/2} \]

- \( A_{BSA} \) ... Body surface area [m²]
- \( H \) ... Body height [cm]
- \( W \) ... Body weight [kg]


\[ A_{BSA} = \text{constant} \times H^{0.42} \cdot W^{0.725} \]

- \( A_{BSA} \) ... Body surface area [m²]
- \( H \) ... Body height [cm]
- \( W \) ... Body weight [kg]
- \( \text{constant} \) ... Empirical constant 0.725

3. Haycock [Haycock, 1978]

\[ A_{BSA} = \text{constant} \times H^{0.42} \cdot W^{0.5378} \]

- \( A_{BSA} \) ... Body surface area [m²]
- \( H \) ... Body height [cm]
- \( W \) ... Body weight [kg]
- \( \text{constant} \) ... Empirical constant 0.02425

4. Gehan & George [Gehan & George, 1970]

\[ A_{BSA} = \text{constant} \times H^{0.42} \cdot W^{0.51496} \]

- \( A_{BSA} \) ... Body surface area [m²]
- \( H \) ... Body height [cm]
- \( W \) ... Body weight [kg]
- \( \text{constant} \) ... Empirical constant 0.0235

5. Boyd [Boyd, 1930]

\[ A_{BSA} = \text{constant} \times H^{0.42} \cdot W^{0.51496} \]

- \( A_{BSA} \) ... Body surface area [m²]
- \( H \) ... Body height [cm]
- \( W \) ... Body weight [kg]
- \( \text{constant} \) ... Empirical constant 0.0235


\[ A_{BSA} = \text{constant} \times H^{0.42} \cdot W^{0.51496} \]

- \( A_{BSA} \) ... Body surface area [m²]

These formulas give good approximations of BSA for adults in western populations. However, for children below 3 years of age, these formulas are not applicable. As there is no literature on BSA formulas for children, BurnCase 3D Core offers only one standard model for young children (Fig. 1), which calculates its average BSA according to the following formula based on this specific body model. This formula was created based on empirical experience by the BurnCase-team.

\[ A_{BSA} = \text{constant} \times H^{0.42} \cdot W^{0.51496} \]

- \( A_{BSA} \) ... Body surface area [m²]
- \( H \) ... Body height [cm]
- \( W \) ... Body weight [kg]
- \( \text{constant} \) ... Empirical constant 0.725

2.3 Model movement

Different support mechanisms have been developed, assisting the process of burn region transfer onto the surface of a virtual body. A virtual camera generates two-dimensional views of the model in virtual 3D space from its current point of view. The current camera view is what the user sees on the BurnCase 3D Core interface. Translation methods on the one hand make it possible to rotate and move this virtual camera in order to view every possible part of the model. On the other hand, selection methods allow the user to mark particular regions on the surface of the model. The mouse is the controller for all these methods. However, it is possible to use other devices such as digital pens or three-dimensional pointers as input devices. As this three-dimensional interaction is the major strength of BurnCase 3D Core compared with conventional two-dimensional approaches, the most important methods are explained in detail below.

2.3.1 Translation methods

Translation into the third dimension (z-axis) is provided by turning the mouse wheel or pressing the middle mouse button, while translating the model into the conventional two-dimensional co-ordinate system (x- and y-axis) is provided by clicking and dragging with the right mouse button down. The left mouse button applies rotation. Because of the same dimensional problem for rotations as for translations BurnCase 3D Core offers a Virtual Trackball for rotating the model in three dimensions. This
trackball can be imagined as a half sphere in the middle of the display coming out of the monitor (Fig. 2). The two-dimensional movements of the mouse cursor are projected onto this virtual sphere, resulting in spinning the sphere in three dimensions. Clicking outside the sphere causes the sphere to rotate around the normal of the monitor plane, providing rotations in all three dimensions. This Virtual Trackball gives the user the opportunity to access every region of the model surface. The centre of such rotations is by default the centre of the model, but can be translated as well. One possibility to move the rotation centre is the Look-At function, which is described below.

2.3.2 Quick-Views

In order to improve usability, it is possible to view certain standard regions of the model directly by clicking on the Quick-View Panel. This panel shows an image of the model with certain hot spots that change colour when the user moves the mouse cursor over them. By clicking on these hot spots the user can automatically translate, rotate, and zoom the model to make the virtual camera point at the desired body area. Additionally, the panel allows users to add their own Quick-Views.

2.3.3 Look-At function

Another tool for changing the point of view of the virtual camera is the Look-At function. When the user clicks on a certain point on the model surface, the Look-At function calculates the camera position and direction that displays a view straight onto the clicked surface point. It not only changes the camera position but also moves the rotation centre into the clicked point. This allows rotations of the model around the region of interest. This function keeps the current zoom setting, which means that the distance from the virtual camera position to the centre of the desired region is equal to the distance to the previous rotation centre.

2.4 Applied computer technologies

The graphic model visualization of BurnCase 3D Core is fully based on OpenGL, a modern state-of-the-art graphics library, widely used for simulating virtual environments. This technology, which is strongly supported by most graphic card producers, is used for displaying three-dimensional scenes and provides standard interaction mechanisms.

BurnCase 3D Core is designed to use an exchangeable, SQL-92 compatible relational database system for all data management routines. BurnCase 3D Core 2003 ships with Microsoft™ SQL-Server Desktop Engine (MSDE). Thus, it is possible to access all the acquired information by third-party data analysis systems. Communication between BurnCase 3D Core and the database system is realized through the Borland Database Engine (BDE). By using this state-of-the-art database communication layer software, the system is independent of the database manufacturer.

3. Medical data acquisition

Basically, the following steps are necessary to enter diagnosis information into the BurnCase 3D Core system:

1. Define the patient according to sex, age, height and weight.
2. Choose a standard model based on patient characteristics.
3. Move the model into an appropriate position.
4. Transfer injured body regions onto the model surface.
5. Acquire relevant additional data.

This section deals with the different methods of transferring injuries onto the model surface and the possibilities of acquiring additional clinical data in the system.

3.1 Graphic documentation and tools

Once the model mesh is adapted to a patient’s physical constitution, the wound documentation can be applied to the model. The graphic data acquisition of injured regions is as easy as drawing on a sheet of paper, which is the common way of approximating burn surface areas. BurnCase 3D Core provides several drawing tools that allow an exact definition and outlining of a patient’s injured areas. The user draws the wound outline on the two-dimensional visualization of the model, and BurnCase 3D Core projects these two-dimensional contours into the three-dimensional model space on the model’s surface. The marked surface is displayed in contrasting colours and patterns, allowing a clear and intuitive overview of the patient’s injury. Consequently,
different burn degrees and healing states can easily be documented on one three-dimensional model (Fig. 3).

3.1.1 Freehand

The most intuitive drawing function is the freehand function. The surgeon paints the 2D outline of the injured region as a free curve onto the model. The software calculates the underlying 3D area in the current view on the model and displays the affected area in the corresponding colour and pattern.

In principle there are two different possible modes of projecting the 2D outline onto the model:

* Front mode: the system only identifies such surface area as selected that is localized inside the selection outline curve and that heading towards the screen. Thus, only the visible surface will be hit by the selection in this mode.

* Front-and-back mode: the system identifies such surface area as selected that is localized inside the selection outline curve no matter whether it is heading towards the screen or backwards. Thus, both visible and hidden surface will be hit by the selection in this mode.

3.1.2 Rectangle

In order to simplify the selection of entire extremities the surgeons can use the rectangle function. This function draws the selection outline curve in the shape of a rectangle and selects all the surface area that lies inside this rectangle in the current view on the model.

As described in section 3.1.1, there are two selection modes that can be used with the rectangle function: front mode and front-and-back mode. The effect is the same as on the freehand function.

3.1.3 Selection and deselection modes

In addition to the two different modes of selecting areas on the model surface (front vs front-and-back), BurnCase 3D Core offers the possibility of deselecting formerly selected areas again. Thus, the surgeon can either be precise when outlining the injured areas or outline these areas generously and deselect the unaffected areas afterwards.

For the deselection of formerly selected areas, BurnCase 3D Core offers several filter functions that can be applied to simplify the deselection of certain wounds:

* Mark whole surface: by default the system allows the user to select or deselect all the surface of the 3D model.

* Mark selected areas only: by applying this filter the surgeon can reduce the newly affected selection area to formerly selected areas. If a certain region within a complex injury was formerly characterized as burn degree 1 but should be characterized as burn degree 2a, the surgeon simply selects this region and draws a large outline that does not need to exactly fit the region outline. After determination of the affected area, all the area that is part of the selected area will be filtered out. Thus, only the selected burn degree 1 area will be modified by the selection operation.

* Mark unselected areas only: by applying this filter the surgeon can reduce the newly affected selection area to currently unselected areas. Let a certain wound be characterized in its centre, e.g. by burn degree 3. The border of this wound has to be characterized, e.g. by a 2-cm strip of burn degree 2b. The surgeon first draws the central area as burn degree 3 without any filter. Then he/she turns on the filter and redraws the wound outline with the 2 cm border strip. The inner area already characterized as burn degree 3 will not be affected since already selected areas are filtered out by this filter.

These filters provide a highly flexible way of selecting and deselecting injured areas driven by the preferences of the surgeon.

3.1.4 Undo function

Since it is always possible that something has been defined wrongly, BurnCase 3D Core offers a comprehensive undo functionality, saving every step of the selection procedure. The surgeon can therefore undo every selection and go back to former selection states by simply clicking a button one or more times.

3.2 Cross-fading

BurnCase 3D Core allows cross-fading of any photograph with the model. The photo is displayed
semi-transparently and the underlying model shines through. This offers a very simple and intuitive way of transferring wound regions from photos onto the model. The model has to be made to coincide with the patient’s body on the photo. Burned regions can then be transferred by simply outlining the wounds on the photo with the input device. The information gained is thus linked to the information on the photo as the adjusted model position is stored together with the photo and can consequently be subsequently restored.

3.3 Photo documentation

For efficient archiving of digital photographs, BurnCase 3D Core offers an integrated photo documentation system. Photographs can easily be assigned to any body region and timestamp of a patient's treatment history. In this way, the 3D-model functions as a three-dimensional map of photographs. The user can assign photos by sticking "pins" into the model's skin, while each pin can represent one or more photos. It is thus possible to recover photos by choosing a timestamp and clicking on the pin.

3.4 User guide

In order to help and support surgeons in their daily work, BurnCase 3D Core interacts with the user over a special guide dialogue. This user guide helps surgeons to pass the data acquisition process on a step-by-step procedure. The following steps can be dealt with in this guide:
1. choosing or creating the patient;
2. choosing or creating the burn case;
3. acquiring the complementary burn-related data;
4. defining the patient's physical state (height and weight);
5. choosing an appropriate 3D standard model;
6. assigning digital pictures of the current state of the patient.

3.5 Complementary data acquisition

A major problem of a novel documentation system is the lack of a standardized set of complementary data for the documentation of human burn injuries. In view of this, BurnCase 3D Core offers the possibility to define a minimum set of data which has to be acquired. The definition of this data set can be done for each institution. To avoid a plurality of different standards there is the possibility to share these defined data sets with other institutions. To allow the comparability of burn patients and their treatment between several institutions it is essential to have one uniform data set. Based on this defined data set the program checks the completeness of the entered data. Consequently, it is not possible to discharge patients unless their data have been entered completely. To avoid insuperable data fields due to missing data, there is the option to declare a data entry as not acquired or unknown whether acquired in order to be treated separately during statistical analysis.

The complementary data contain information of the following categories:

* Accident
  * Emergency-medical data
    - First aid
    - Condition at place of accident
    - Pre-hospital care
    - Medical care in other hospitals
  * Admission to hospital
    - Condition at admission
    - Previous illnesses
    - Burn-referred auxiliary injuries
    - Non-burn-referred auxiliary injuries
  * Anaesthesiological process data
  * Outcome
  * Stationary complication data

4. Data interpretation and reporting

Various scoring (e.g. ICD, ABSI …) and analysis algorithms can be performed on the acquired injury areas, allowing a wide range of standard reports for diagnostics and scientific studies as well as for accounting tasks. The use of BurnCase 3D Core thus dramatically reduces the work load of documentation purposes for surgeons.

4.1 Data structure

After the medical data acquisition is performed, the selected areas are automatically grouped based on their locations and associated characteristics (e.g.
burn degrees). Physically connected areas of the same characteristic are grouped into one region and are subsequently stored as such in the database. Regions that share borders are grouped into surfaces in order to be accessible as physically associated areas. Afterwards such surfaces and regions can be modified uniformly. The entity that holds all selected regions and surfaces for one point in time (timestamp) is called interaction. Thus, every interaction represents the physical condition of a patient at a certain point in time.

The chronological sequence of all interactions that emerges during the treatment of a patient from the day of the accident to the day of dismissal is stored as one burn case. Since burn cases are always linked to a corresponding patient and one patient may be involved in more than one burn case, the data structure allows multiple burn cases for every patient. Standing data for patients can be imported from standard hospital management systems over standard interfaces. The data structure is displayed in a graphic tree component on the left side of the user interface allowing the user to directly remove, modify or add the entities described above (Fig. 5).

4.2 Determination of ICD-10 codes

To avoid falsified outcomes concerning the version of the ICD (International Classification of Diseases), the design of BurnCase 3D Core allows holding several versions of the ICD simultaneously; the implemented version in the first release is ICD V 2004-GM (German Modification). BurnCase 3D Core is able to determine all relevant ICD-Codes, both from the graphic representation and from the collected complementary data. To determine the ICD-Codes of the graphic representation, it is necessary to map the several ICD categories (T20-T25) to the predefined body regions of the 3D standard model. This mapping is stored in the database, where a corresponding ICD category exists for each anatomical region of the human body. By joining the ICD category and acquired burn degree areas it is possible to determine exactly a comprehensive list of corresponding ICD-Codes. The advantage of this method versus the non-computer-aided method is the exactness and integrity of the identified codes. Besides the codes related to one specific body region, the codes related to burns and corruptions of multiple body regions (ICD-Codes T29-T31) are determined additionally.

4.3 Indices and scores

BurnCase 3D Core calculates the following standard indices and scores of burn injuries immediately after the data have been entered via graphic data acquisition. These indices and scores are based on parameters such as surface area and location as well as the area’s characteristic (e.g. burn degree).

BurnCase 3D Core supports the following standard indices and classification codes:

* Burned surface total (2a-4), deep fraction (2b-4), superficial fraction (2a), separated surface per characteristic
* Body mass index (Quetelet Index)\(^{10}\)
  \[ \text{BMI} = \frac{C_W}{C_H^2} \]
  \(C_W\)… Body weight [kg]
  \(C_H\)… Body height [m]
* ABSI (Abbreviated Burn Severity Index)\(^{11}\)
  \[ Z = C_A \times P_M + C_A \times P_S + C_A \times P_A + C_A \times P_F + C_A \times P_BSA - C \]
  \(P_M\)… Probability of mortality
  \(P_S\)… Points for sex (female=1, male=0)
  \(C_A\)… Empirical constant 0.86
  \(P_A\)… Points for age (0-20y=1, 21-40y=2, 41-60y=3, 61-80y=4, >80y=5)
  \(C_A\)… Empirical constant 1.08
  \(P_F\)… Points for presence of full-thickness burns (yes=1, no=0)
  \(C_F\)… Empirical constant 1.02
  \(P_BSA\)… Points for percent BSA burned (-10%=1, -20%=2,...-100%=10)
  \(C_BSA\)… Empirical constant 0.95
  \(C\)… Empirical constant 9.01
* Baux Burn Score (Cape Town Modified)\(^{12}\)
  \[ Z = C_A \times P_M + C_A \times P_A + C_A \times P_BSA - C \]
  \(P_M\)… Probability of mortality
  \(P_A\)… Age in years
  \(C_A\)… Empirical constant 0.09
  \(P_BSA\)… Percent BSA burned (0-100)
\[ C_{BSA} \ldots \text{Empirical constant 0.078} \]
\[ P_G \ldots \text{Inhalation injury grade (none=0, mild=1, moderate=2, severe=3)} \]
\[ C_G \ldots \text{Empirical constant 1.751} \]

\[ F_B = C_G \times P_G, \times 4 \]
\[ F_B \ldots \text{Fluid resuscitation [ml] within first 24 hours} \]
\[ C_W \ldots \text{Body weight [kg]} \]
\[ P_{BSA} \ldots \text{Percent BSA burned deep (0-100)} \]

* Baxter/Parkland formula \(^{13}\)

In order to allow the output of all acquired data for printing, archiving, and exchanging, BurnCase 3D Core provides a state-of-the-art reporting functionality. Despite constant efforts to rely completely on electronic patient records and electronic clinical pathways, it is inevitable in many departments that paper-bound reports are used. This partly results from the fact that many of the deployed software systems in individual departments are not or only insufficiently interoperable.

BurnCase 3D Core offers the following standard reports:

* Patient standing data
* Complementary data
* Graphic report (pictures of views on the 3D Model)
* Injury listing grouped by body regions
* Injury listing grouped by characteristics (e.g. burn degree)
* ABSI score
* ICD report
* Lund and Browder Chart \(^{14}\)
* Burn case history of interactions (in chronological order)

N.B. The Lund and Browder Report may show different results concerning the injured surface area. This is due to the fact that BurnCase 3D Core not only calculates the figures on this special report based on the calculated surface area of the 3D model but also takes the body surface distribution of the original Lund and Browder Chart \(^{14}\) into account. The body regions of the 3D model are mapped to the cruder Lund and Browder regions. The surface areas of these regions are than transformed to fit the percentages of the Lund and Browder Chart. This results in deviated percentage values on the Lund and Browder report.

4.4 Time line

In order to navigate quickly through the treatment process of a patient, BurnCase 3D Core offers a time line function. In this time line, visualized as slider component, all interactions with a textual explanation and a timestamp are arranged. By clicking on such an entry the model changes automatically to the corresponding condition.

5. Auxiliary functionalities

5.1 Telemedicine

To facilitate collaborative work, either to obtain the opinion of a medical expert or to ensure the possibility of a multi-centre study, it is mandatory to be able to transmit a patient’s data set from one BurnCase 3D Core client to another. For this purpose it is possible to export one or more patients into a file. The format of this file is proprietary and encrypted in order to avoid improper use of the exported data and to guarantee the requirements of data security. Such an encrypted and exported file can only be imported into another BurnCase 3D Core system. In order to identify the source of a certain data set, each institution holds a unique identifier, which is packed into the data set and maintained by the distributor of the system.

5.2 Interfaces

BurnCase 3D Core is designed to be able to communicate with the software most commonly found in hospitals. The possible communication covers the following data types:

* Patient standing data
* Laboratory data
* ICD-Codes
* DRG-relevant supplementary data

It is not planned to integrate a DRG-Grouper into BurnCase 3D Core, but BurnCase 3D Core will provide all necessary data for an external DRG-Grouper, as already provided by existing systems.

5.3 Picture export function

In order to be able to use the graphic documentation status of a patient in external applications, BurnCase 3D Core offers the possibility to copy the actual model view directly into the windows clip board, from where it can be inserted directly into other applications. Additionally, the actual view can be saved as a graphic file (JPG format) on any data medium.
RÉSUMÉ. La recherche, la science et l’estimation des coûts dans le champ des brûlures se basent sur l’évaluation précise et la documentation des lésions dues aux brûlures. Cette documentation prend du temps et nécessite l’emploi de beaucoup de personnes. Pour réduire le travail nécessaire pour la documentation et la codification, un projet de recherche a été activé par Upper Austrian Research, un département de recherche de l’État Fédéral de la Haute Autriche, l’Université des Sciences Appliquées Hagenberg, et les docteurs Herbert Haller et Christian Rodemund. L’idée de base est de dépeindre soit la lésion de la brûlure soit les procédures chirurgicales sur un modèle à trois dimensions. Ces données génèrent automatiquement un texte clair, comme aussi des informations graphiques pour ce qui concerne l’extension et le degré des brûlures, conjointement avec tous les codes nécessaires, comme l’ICD 9 ou 10, OPS, les codes MEL, la probabilité de survie, ABSI, et des autres. L’entrée des données peut être effectuée comme une description de la condition de la brûlure (diagnostique), la procédure opératrice, la procédure de médication et les conseils pour les infirmiers. La séquence chronologique de l’entrée de ces données peut être visualisée et imprimée conjointement avec les codes correspondants. En outre, il est possible de conserver les photographies et de les visualiser en cas de besoin. Le système graphique est lié à une base de données, qui conserve tous les détails nécessaires pour la documentation des brûlures pour ce qui concerne l’accident, les soins d’urgence, l’hospitalisation, les données anesthésiologiques, le résultat final, le registre des complications, etc. Cette base de données se base sur les standards ABA-WHO et doit être régulée selon les exigences de l’EBA ou des centres polycentriques nationaux. Ce système est paramétré de manière flexible afin que ceux qui l’utilisent puissent décider quelles données ils désirent enregistrer.

BIBLIOGRAPHY


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